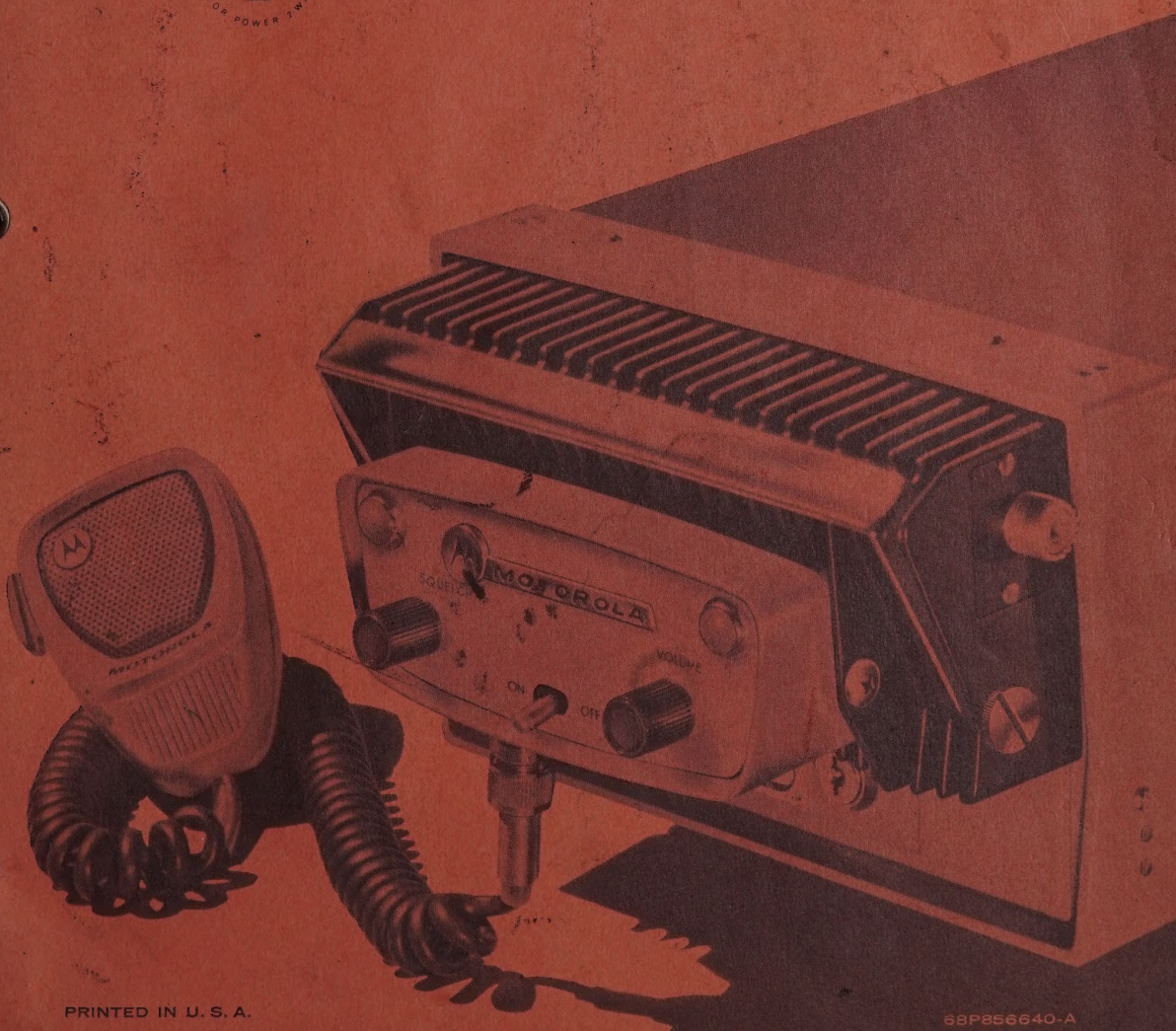
Mobile FM Two-Way Radio

144-174 MC 25 W RF POWER 12 VDC



PRINTED IN U. S. A.

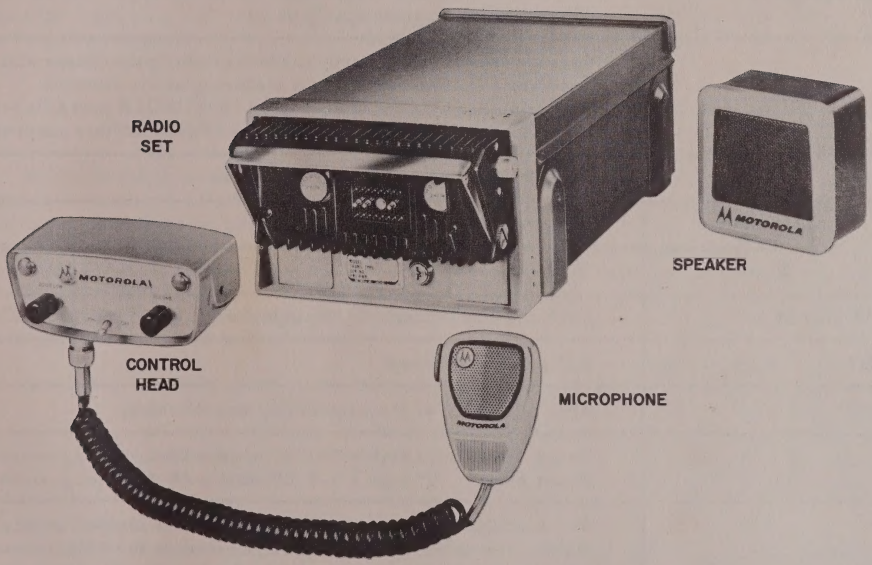
68P856640-A

MOTOROLA

"T-POWER" MOBILE

FM TWO-WAY RADIO

25 W RF POWER
144-174 MC
12 VDC



MOTOROLA INC. COMMUNICATIONS DIVISION

Engineering Publications *4501 W. Augusta Blvd.* *Chicago 51, Illinois*

Printed in U.S.A.
11/3/59-RCS

68P856640
Issue - A

SECTION INDEX
DESCRIPTION
INSTALLATION & OPERATION
TRANSMITTER
RECEIVER
POWER SUPPLY
MAINTENANCE
NOISE SUPPRESSION

GUARANTEED PERFORMANCE SPECIFICATIONS

MODELS		U43GGT-1000C Series
INSTALLATION		Front Mount or Trunk Mount
FREQUENCY		144-174 mc
TRANSMITTER RF POWER OUTPUT		25 watts minimum
TRANSMITTER MODULATION		40F3: ±15 kc for 100% at 1000 cps or 20F3: ± 5 kc for 100% at 1000 cps
RECEIVER SENSITIVITY		Less than 0.5 microvolt for 20 db quieting 50 ohms RF input impedance
RECEIVER SELECTIVITY		-100 db at ±15 kc (30 kc channel spacing) -100 db at ±32 kc (60 kc channel spacing)
RECEIVER MODULATION ACCEPTANCE		± 5 kc (30 kc channel spacing) ±15 kc (60 kc channel spacing)
METERING		Chassis mounted metering sockets on the transmitter and receiver facilitate convenient metering of all circuits essential to tuning and checking. A MOTOROLA portable test set or a 0-50 microampere meter can be used for this purpose.
INPUT VOLTAGE		12 V DC Positive or Negative Ground
CURRENT DRAIN (TOTAL)	Standby	6.5 amperes
	Transmit	15 amperes
INTERMITTENT DRAIN		Each crystal heater: 0.65 amperes
POWER SUPPLY		Fully transistorized
WEIGHT		Approximately 47 lbs. (including accessories)
DIMENSIONS		Trunk Mount: 6" high x 9-7/8" wide x 19-1/4" long overall Front Mount: 6" high x 9-7/8" wide x 20-3/4" long overall
LICENSING INFORMATION		The MOTOROLA 2-way radio equipment described in this manual meets or exceeds all requirements for FCC licensing, and is included in the FCC "List of Equipment Acceptable for Licensing in the Radio Services other than Broadcast". Identification of "Transmitter Type" (XMTR TYPE) appears on the equipment nameplate and is: Type Number.....CC3012 (144-174 mc) for licensing under FCC rule parts 10, 11, 16, and 21.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

FOREWORD

PURPOSE OF THE MANUAL

This manual offers the serviceman complete installation, operation, maintenance and service information on the MOTOROLA 2-way radio models described in it.

The manual will serve as a ready reference for the experienced technician and also as a step-by-step guide for the inexperienced man.

For convenience and quick reference, the manual is divided into separate sections. Each section has complete alignment, service and maintenance information on its chassis and/or kits and includes its own diagrams, details and parts lists. For example, the Receiver section contains complete information on the receiver models described in it. Installation and operation of the complete radio set are covered in a separate section. All major section paragraph headings and diagrams are listed for the serviceman's use in the Table of Contents.

THE "RADIO SET"

MOTOROLA 2-way radio equipment is packaged as a radio set plus accessories. The radio set is assigned a model number for identification purposes. It includes the transmitter, receiver, and power supply chassis in a single housing. This model number describes the package specifically. Use the model number in its entirety when making inquiries about the equipment.

Example: U43GGT - 1000C - describes a 144-174 mc, 60 kc channel spaced set with a 25 watt, one frequency transmitter, and a transistorized power supply.

It is evident that the model number is easier to use and is more specific than a word description.

The accessories are identified by an accessory group number which includes those other items essential to completing the radio installation such as; antenna, speaker, cables, etc. Use this number when referring to a specific group of accessories.

Example: EA1100B - describes an accessory group which includes a one-frequency control head and microphone, 12 VDC cable kit, installation kit for a 10-inch housing, roof top antenna, and a speaker.

In addition to these model and group numbers, Motorola has assigned identifiers to all chassis and kits. These are for inventory and stock control purposes and should be used by the serviceman when requesting information on them or when ordering replacements. Use the assigned number identifiers. It will be to your benefit. These are the only sure means of describing the radio equipment and its many parts.

The radio set model number is metal stamped on the equipment nameplate along with the transmitter type number, serial number and type of primary power. Chassis and kit numbers are rubber stamped on the chassis or kit itself.

For the serviceman's use, breakdown cross reference charts on radio set models and accessory groups are located in the front matter section of the manual.

PRODUCTION CHANGES

When production and engineering changes are incorporated into the equipment, a revision numeral is assigned to the chassis or kit affected, e.g.; TA237W becomes TA237W-1, with the first revision. This chassis number complete with revision numeral is stamped on the chassis at the time of production, and the revision numeral becomes an integral part of the chassis identifier.

A schematic diagram number complete with its issue letter is also stamped on each chassis. This establishes direct correlation between the chassis and its schematic. The schematic issue is advanced each time a change occurs in the chassis. The most recent issue is stamped on the chassis.

INSTRUCTION MANUAL REVISION BULLETINS

Those changes which occur after an instruction manual is printed are covered by the Instruction Manual Revision Bulletins. These bulletins give the reader complete information on the change including pertinent parts listing data from which the instruction manual can be corrected.

NATIONAL SERVICE ORGANIZATION

Motorola provides a nation-wide service organization to assure availability of reliable

maintenance at all times. These privately-owned and operated factory authorized service stations are equipped and qualified to handle complete installation of all Motorola two-way radio equipment. They are also equipped and licensed to make the frequency and modulation measurements required by the FCC. Each station has the precision test equipment, stocks of replacement parts, and shop facilities necessary to maintain your system to factory specifications. Call on them for complete maintenance service! Consult your local telephone directory for the address of the nearest Motorola Service Station, or write to:

National Service Manager
Motorola Communications and Industrial Electronics Inc., 4501 W. Augusta Boulevard,
Chicago 51, Illinois

REPLACEMENT PARTS ORDERING

MOTOROLA maintains parts and service depots in Dallas, Texas, and Burlingame, California, to supplement the activities of the Parts and Service Department in Chicago. The following table outlines the services provided by these facilities:

Addresses:

Factory: Crystal Service Department,
916 N. Kilbourn Ave.,
Chicago 51, Illinois

Chicago Parts and Service Department:
4910 West Flournoy Street
Chicago 44, Illinois

Dallas Parts Depot:
7138 Envoy Court,
Dallas 35, Texas

Burlingame Parts Depot:
1616 Rollins Road,
Burlingame, California

Area Served	Parts & Service	Crystals	Resonant Reeds
Central and Eastern area	Chicago Parts Dept	Factory	Factory
Southern area	Dallas	Factory	Dallas
Western area	Burlingame	Factory	Burlingame

These offices are fully equipped to give this service. When ordering replacement parts, the complete number identification of the item must be used whether it be a component, kit or complete chassis. This will fix proper identification and insure receipt of the desired item. Complete number identification should also be used when requesting equipment information.

Crystal orders should specify crystal type number, crystal frequency, carrier frequency and the chassis model number in which the crystal is to be used.

Orders for VIBRASENDER and VIBRASPONDER Resonant Reeds should specify the type number and frequency and should identify the owner and operator of the PRIVATE LINE network in which these items are to be used.

CAREFUL USE OF THE INSTRUCTION MANUAL AND THE MANY SUGGESTIONS CONTAINED IN IT WILL FURTHER INSURE PROPERLY INSTALLED AND MAINTAINED RADIO EQUIPMENT.

THE EQUIPMENT DESCRIBED IN THIS MANUAL IS MANUFACTURED UNDER ONE OR MORE OF THE FOLLOWING MOTOROLA U. S. PATENTS:

				2,830,200
RE-24,110	2,547,027	2,688,059	2,759,052	2,833,994
D,159,182	2,566,759	2,691,094	2,759,103	2,834,879
2,343,115	2,583,032	2,691,560	2,770,721	2,835,794
2,404,359	2,602,842	2,699,425	2,777,950	2,846,596
2,439,408	2,608,648	2,705,281	2,784,263	2,852,730
2,439,412	2,608,649	2,713,664	2,799,001	2,860,239
2,459,675	2,626,384	2,731,555	2,799,010	2,864,943
2,472,021	2,636,652	2,738,466	2,799,832	2,883,521
2,524,300	2,637,782	2,740,891	2,808,507	2,888,652
2,524,534	2,650,333	2,743,144	2,809,236	2,899,547
2,547,023	2,652,542	2,743,361	2,810,068	2,901,601
2,547,025	2,662,942	2,750,451	2,811,590	2,905,909

Other U. S. Patents Pending

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MOTOROLA

MODEL CHART

CARRIER SQUELCH "T-POWER"

FM TWO-WAY RADIO SETS

144-174 MC 12VDC

CODE

[X] = ONE ITEM INCLUDED

◪ = ONE ITEM INCLUDED WITH ORDER FOR FIVE (OR LESS) RADIO SETS.

⊘ = ONE ALTERNATE ITEM INCLUDED. CHOICE DEPENDENT UPON FREQUENCY RANGE.

[2] = TWO ALTERNATE ITEMS INCLUDED. CHOICE DEPENDENT UPON FREQUENCY RANGE.

*REPRESENTS A SERIES OF MODELS AND NOT A SPECIFIC MODEL. THE SPECIFIC MODEL, AS STAMPED ON THE CHASSIS, IS DETERMINED BY ITS APPLICATION.

ITEM	DESCRIPTION	REFERENCE DIAGRAM
*TRD1170AA/TA237W	RECEIVER, 1-FREQUENCY	63E862486
*TRD1170AC/TA237W-R2	RECEIVER, 2-FREQUENCY	63E862487
*TRD1170AB/TA237S	RECEIVER, 1-FREQUENCY	63E862486
*TRD1170AD/TA237S-R2	RECEIVER, 2-FREQUENCY	63E862487
TTD1060AA	TRANSMITTER, 1-FREQUENCY	63E856652
*TTD1060AB	TRANSMITTER, 2-FREQUENCY	63E856652
TPN600BA	POWER SUPPLY	63E856657
TK603	SUB-PANEL KIT	
TK661	FRONT PANEL KIT	
K-9045	HOUSING	
K-9322	TUNING TOOL KIT	
RN1-A	TRANSMITTER CONTROL CRYSTAL	
RM10-A	RECEIVER CONTROL CRYSTAL	
G03	RECEIVER I-F CRYSTAL	
TLN6155A	FILTER KIT, 2-FREQUENCY	

MODEL	NO. OF RCVR. FREQ.	NO. OF XMTR. FREQ.	CHAN. SPACING	ACCESSORY GROUP	*TRD1170AA/TA237W	*TRD1170AC/TA237W-R2	*TRD1170AB/TA237S	*TRD1170AD/TA237S-R2	TTD1060AA	*TTD1060AB	TPN600BA	TK603	TK661	K-9045	K-9322	RN1-A	RM10-A	G03	TLN6155A
U43GGT-1000C	1	1	60 KC	EA, EB, EE or EF (1000 SERIES)	X					X	X	X	X	X	◪		⊘		X
U43GGT-1010C	1	2	60 KC	EA, EB, EE or EF (1000 SERIES)	X						X	X	X	X	◪		⊘		X
U43GGT-1030C	2	2	60 KC	EA, EB, EE or EF (1000 SERIES)		X					X	X	X	X	◪		[2]		X X
U43GGT-1100C	1	1	30 KC	EA, EB, EE or EF (1000 SERIES)			X		X			X	X	X	◪		⊘		X
U43GGT-1110C	1	2	30 KC	EA, EB, EE or EF (1000 SERIES)			X				X	X	X	X	◪		[2]		X
U43GGT-1130C	2	2	30 KC	EA, EB, EE or EF (1000 SERIES)				X			X	X	X	X	◪		[2]		X X

EPD-1704-C

MOTOROLA

ACCESSORIES FOR
CARRIER SQUELCH "T-POWER"
FM TWO-WAY RADIO SETS
144-174 MC 12VDC

CODE

[X] = ONE ITEM INCLUDED

[/] = ONE ALTERNATE ITEM INCLUDED. CHOICE DEPENDENT UPON FREQUENCY RANGE.

GROUP NUMBER	TYPE OF INSTALLATION	NO. OF FREQ.	CONTROL HEAD	MICROPHONE	SPEAKER
EA1100C	REAR-MOUNT	1	"WIRED-IN" MIC.	SUPPLIED	3 OHM PM
EA1101C	REAR-MOUNT	1	"WIRED-IN" MIC.	SUPPLIED	POWER VOICE
EA1105B	REAR-MOUNT	1	WITH MIC. CONN.	LESS MIC.	3 OHM PM
EA1106B	REAR-MOUNT	1	WITH MIC. CONN.	LESS MIC.	POWER VOICE
EA1107B	REAR-MOUNT	1	WITH MIC. CONN.	LESS MIC.	3 OHM PM
EA1110C	REAR-MOUNT	2	"WIRED-IN" MIC.	SUPPLIED	3 OHM PM
EA1111C	REAR-MOUNT	2	"WIRED-IN" MIC.	SUPPLIED	POWER VOICE
EA1115B	REAR-MOUNT	2	WITH MIC. CONN.	LESS MIC.	3 OHM PM
EA1116B	REAR-MOUNT	2	WITH MIC. CONN.	LESS MIC.	POWER VOICE
EA1117A	REAR-MOUNT	2	WITH MIC. CONN.	LESS MIC.	3 OHM PM
EB1100C	FRONT-MOUNT	1	"WIRED-IN" MIC.	SUPPLIED	3 OHM PM
EB1101C	FRONT-MOUNT	1	"WIRED-IN" MIC.	SUPPLIED	POWER VOICE
EB1105B	FRONT-MOUNT	1	WITH MIC. CONN.	LESS MIC.	3 OHM PM
EB1106B	FRONT-MOUNT	1	WITH MIC. CONN.	LESS MIC.	POWER VOICE
EB1107B	FRONT-MOUNT	1	WITH MIC. CONN.	LESS MIC.	3 OHM PM
EB1110C	FRONT-MOUNT	2	"WIRED-IN" MIC.	SUPPLIED	3 OHM PM
EB1111C	FRONT-MOUNT	2	"WIRED-IN" MIC.	SUPPLIED	POWER VOICE
EB1115B	FRONT-MOUNT	2	WITH MIC. CONN.	LESS MIC.	3 OHM PM
EB1116B	FRONT-MOUNT	2	WITH MIC. CONN.	LESS MIC.	POWER VOICE
EB1117A	FRONT-MOUNT	2	WITH MIC. CONN.	LESS MIC.	3 OHM PM
EE1005AM	REAR-MOUNT	1	WITH MIC. CONN.	SUPPLIED	3 OHM PM
EF1005AM	FRONT-MOUNT	1	WITH MIC. CONN.	SUPPLIED	3 OHM PM
EE1015AM	REAR-MOUNT	2	WITH MIC. CONN.	SUPPLIED	3 OHM PM
EF1015AM	FRONT-MOUNT	2	WITH MIC. CONN.	SUPPLIED	3 OHM PM

ITEM	DESCRIPTION	REFERENCE DIAGRAM
TCN6000AA	CONTROL HEAD "WIRED-IN" MIC., 1-FREQ., FRONT MOUNT	63E856643
TCN6000AB	CONTROL HEAD "WIRED-IN" MIC., 2-FREQ., FRONT MOUNT	63E856643
TCN6000AE	CONTROL HEAD WITH MIC. CONNECTOR, 1-FREQ., FRONT MOUNT	63E856643
TCN6000AF	CONTROL HEAD WITH MIC. CONNECTOR, 2-FREQ., FRONT MOUNT	63E856643
TCN6001AA	CONTROL HEAD "WIRED-IN" MIC., 1-FREQ., REAR MOUNT	63E856644
TCN6001AB	CONTROL HEAD "WIRED-IN" MIC., 2-FREQ., REAR MOUNT	63E856644
TCN6001AE	CONTROL HEAD WITH MIC. CONNECTOR, 1-FREQ., REAR MOUNT	63E856644
TCN6001AF	CONTROL HEAD WITH MIC. CONNECTOR, 2-FREQ., REAR MOUNT	63E856644
TK611	CABLE KIT, 12 VOLTS, FRONT MOUNT	63E856643
TKN6006A	CABLE KIT, 12 VOLTS, REAR MOUNT	63E856644
TU324A	3 OHM PM SPEAKER	
TU433A-12V	POWER VOICE SPEAKER	
TU316L	ANTENNA, 144-152 MC	
TU316M	ANTENNA, 152-162 MC	
TU316H	ANTENNA, 162-174 MC	
TLN6000A	INSTALLATION KIT	
TLN6001A	MOUNTING BRACKET KIT	
TLN6014A	6 TO 12 VOLT DC CONVERTER	
TKN6013A	CABLE KIT, REAR MOUNT	
TU353A	MICROPHONE	
TKN6014A	CABLE KIT, FRONT MOUNT	

EPD-1705-A

DESCRIPTION

1. INTRODUCTION

The new MOTOROLA "T-Power" mobile FM two-way radio sets incorporate features which reduce maintenance and provide full interchangeability between front and rear mount radio sets. These features are:

(1) transistorized power supply

(2) interchangeable radio set drawer assembly

(3) "plug-in" front mount control head

a. Transistorized Power Supply

The new MOTOROLA fully transistorized power supply uses long-life power transistors in place of conventional vibrator units. The transistorized supply provides operating voltages for both transmitter and receiver. The use of transistors eliminates the cost of replacing vibrators and improves overall operation of the radio set.

b. Interchangeability

The radio set housing mounts either under the vehicle dash or in the trunk of the car. The same drawer assembly, including transmitter, receiver and power supply, slides into the housing in either type of installation. In mobile radio fleets where both front- and rear-mount installations are used, this design provides full flexibility of exchange between vehicles. Rear mount radio sets are remotely controlled by means of a dash-mounted control head. The drawer assemblies can be interchanged between vehicles with positive or negative ground electrical systems.

c. Plug-In Control Head

In dash-mount installations the control head plugs into a receptacle on the front of the radio set drawer assembly. Two lockscrews secure it in place. In trunk-mount installations the control head mounts on the vehicle dash and a cable kit makes the connections between the control head and the receptacle on the front of the radio set. Thus, the same radio set drawer assembly can be easily exchanged between front and rear-mount housings.

2. GENERAL DESCRIPTION

a. "T-Power" Radio Set

The basic radio set consists of a transmitter, receiver, power supply and housing. The transmitter, receiver and power supply are assembled together to form a drawer unit which slides into the housing. External connections are made through receptacles on the front of the housing. The radio set can be installed either under the dash (front) or in the trunk (rear) of the vehicle.

Various "T-Power" models are available as shown in the model chart which precedes this section of the manual.

b. Accessory Groups

In addition to the basic radio set, an accessory group is required to complete the installation. The accessory group includes the control head, cable kit, antenna, mounting hardware and other required items. Accessory groups are classified for either rear-mount or front-mount installations.

(1) Rear-Mount Accessory Groups

Rear-mount accessory groups include a control head designed for mounting on the vehicle dash and a cable kit for interconnecting the radio set and control head.

Accessory groups are listed in the accessory chart in the front of this manual.

(2) Front-Mount Accessory Groups

Front-mount accessory groups include a plug-in control head which mounts directly on the radio set front panel.

These accessory groups are listed in the accessory chart at the front of this manual.

3. DESCRIPTION OF RADIO SET ITEMS

The items included in the radio set are summarized on the model chart at the front of this manual. Major units, such as the receiver, transmitter and power supply are fully described in the various sections of this manual, as indicated in the table of contents. Items not covered in separate sections are described in the following paragraphs.

a. Sub-Panel Kit

The TK603 Sub-Panel Kit is used with the radio sets covered in this manual. This kit includes the front and rear tie-plates and the hardware required to assemble the transmitter, receiver and power supply into a single mechanical unit. This three chassis assembly then slides into the housing as a drawer unit. The power supply connector mounts on the front sub-panel of this kit, making the receptacle available for an external mating plug. A coaxial cable which interconnects the receiver rf circuit to the antenna relay is also included with this kit.

b. Housing

The radio sets are housed in the K-9045 Housing. This housing is 9-7/8 inches wide x 18-1/2 inches deep x 6 inches high. The housing is a heavy gauge steel cabinet designed to house the receiver, power supply and transmitter assembly as a drawer unit. The housing is finished in an automotive type baked enamel. Housing tops are removable for access to components mounted on the chassis.

c. Front Panel

The TK661 Front Panel forms the exterior front panel of the drawer unit. This panel includes an extruded aluminum heat radiator and the two power transistors used with the power supply. A chrome-plated bar on this panel is a carrying handle when pulled up and outward. Spring catches on the heat radiator fins secure the handle when not in use. A key-lock mounted on this panel secures the radio set against unauthorized personnel. Metering ports give access to the transmitter and receiver meter sockets. The 19-pin power supply receptacle is accessible through a hole in this panel. The antenna receptacle for the radio set is mounted on this panel. A coaxial cable connects this receptacle to the ANT receptacle on the transmitter chassis.

d. Crystals

The crystals used in the radio set are listed in the radio set model chart at the front of this manual. If crystals are re-ordered refer to the REPLACEMENT PARTS ORDERING paragraph in the FOREWORD of this manual.

e. Alignment Tool Kit

The K-9322 Alignment Tool Kit is included with the radio set at the rate of one kit per five sets (or less, if less than five are ordered). This kit includes the tool required for aligning the transmitter and receiver.

4. DESCRIPTION OF STANDARD ACCESSORIES

a. Cable Kits

Cable kits are not supplied as part of the radio set model, but are included in the accessory group, which must be ordered separately for each type of installation. The type of cable kit used depends upon front or rear mount installation and upon one-frequency or two-frequency operation. The cable kits available are listed in the accessory chart.

b. Installation Kit

The installation kit includes a distributor suppressor, by-pass capacitors, cable clamps and mounting hardware for installing the radio sets. It is used for front and trunk mount models.

c. Antennas

The TU316 Series Antennas are designed for roof top installation in mobile radio sets operating in the 144-174 mc band. The antenna consists of a steel rod, coaxial lead-in cable and connector. Antenna rods are cut to length at the factory for specific frequencies. The antennas available are as follows:

Model No.	Frequency Range
TU-316-L	144-152 mc.
TU-316-M	152-162 mc.
TU-316-H	162-174 mc.

d. PM Speaker

The TU324A Trunnion Mount Speaker is designed for mounting on a suitable flat surface in the vehicle. It can be mounted directly on the firewall or dashboard or on the steering column, when the TK395 Adapter Kit is used. The unit consists of a 3-ohm, 5 inch PM speaker installed in a louvered steel housing. An eight-foot, 2-conductor cable is included.

e. "Power-Voice" Speaker

The Model TU433A-12V "Power-Voice" Speaker is a combination speaker and transistorized audio amplifier is a louvered steel housing. Two power transistors in a transformer-coupled, push-pull circuit boost the receiver audio output to a 15-watt level with less than 10% distortion. This unit is especially desirable for all high ambient noise applications or where the receiver must be monitored at some distance from the vehicle.

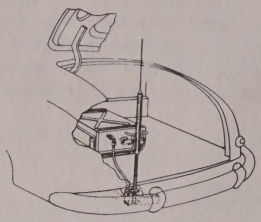
f. Control Heads

The control head provides the required control facilities for operation of the radio set. Two basic models are available for front mount radio sets and two are available fro rear mount models. Model variations include one or two-frequency operation and "wired-in" microphone or provisions for detachable microphone.

Front-mount models are designed for direct plug-in connection to the radio set front panel. Control heads for rear-mount models are mounted on the vehicle dash with an adjustable angle bracket.

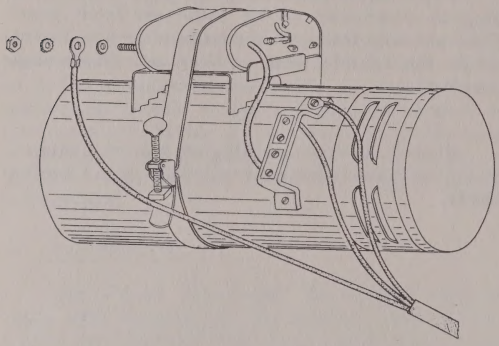
Refer to the intercabling diagrams in this instruction manual for wiring details of the control heads.

OPTIONAL ACCESSORIES



TAE6010 BUMPER MOUNT ANTENNA

For use where rooftop antenna is not practical or desirable. Also can be mounted on side of truck cab or other flat surface. Use TLN6181A Mtg. Kit for bumper mount, TLN6182A for flat surface mounting.



P-346 GENERATOR FILTER

Used to attenuate generator interference. Rated at 40 amperes.

SPECIAL PURPOSE KITS

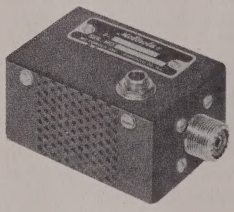
K-8292 Hood Wiper--Suppressor. Used to reduce interference from noise generated in the vehicle.

K-7257 Extension Cable. Provides full length ground return from rear-mount radio set to battery. Consists of two 17-foot lengths No. 4 cable with lugs at each end.

Long Cable Kits. For limousine and truck installations. With 20-ft cables instead of 17-ft. cables. Fully interchangeable.

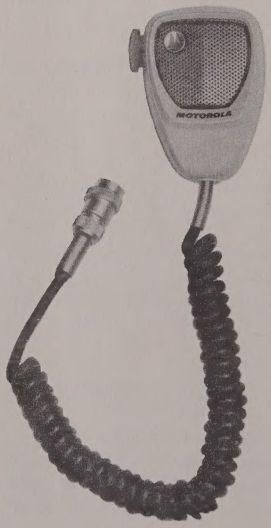
TU546 SERIES PORTABLE TEST SET

For testing and alignment of Motorola transmitters and receivers. Cable and plug mate with METER sockets on radio chassis.



P-7208 WATTMETER DUMMY LOAD

Used with portable test set to measure transmitter rf power output.



"PLUG-IN" UNITS
TU353A MICROPHONE
TU475 TELEPHONE HANDSET

For control heads with 4-pin MIC receptacle. Built-in transistorized pre-amplifier. Moving coil element for improved voice reproduction. 12' coiled tinsel cord. DPST push-to-talk switch. Mic. and handset interchangeable.

EPD-1741(CE044) EPD-1491 MC1971 EPD-1742(CE1070) EPD-1490

INSTALLATION AND OPERATION

INSTALLATION

Installation instructions are packed and shipped with the radio set accessories.

OPERATION

1. PRE-OPERATIONAL CHECKS AND ADJUSTMENTS

a. Purpose

The purpose of the pre-operational check is to ascertain that the mobile radio set is operating properly when initially placed in service.

The equipment has been accurately aligned at the factory for optimum performance. It is possible, however, that mishandling in transit may have disturbed some of the adjustments. It is essential, therefore, that a pre-operational check be made to assure proper operation when the equipment is installed.

b. Pre-Installation Bench Check

The radio set can be checked before installation using a bench test set-up with permanently installed cabling and control facilities and a battery or battery eliminator. The dc supply must be a 12-volt source. An antenna dummy load, rf wattmeter or operational antenna must be connected to the radio set ANTENNA connector on the front panel. A test set for metering the transmitter and receiver should be available. This type of laboratory set-up is particularly useful where many sets must be checked, however, it does not give a complete check of the actual cables, control unit and speaker to be used.

The ideal set-up for a pre-installation check is a bench test in which the radio set, cable kit, control head, speaker and antenna are assembled to form a complete facsimile of the vehicular installation. The pictorial cabling diagrams in the installation instructions packed with the cable kit show how to interconnect the various items.

Once the test set-up is assembled the equipment can be turned on and operated as described in the following paragraphs.

c. Installation Checks

Before placing this radio set in operation make the following installation checks:

(1) General

Be sure all cable connections and bolted connections are secure. Make sure all fuses are in place and all tubes are firmly seated.

(2) DC Input

(a) Be sure the equipment is connected with the proper polarity to a 12-volt dc electrical system. Set the ON-OFF toggle switch to the ON position. This applies the dc input to the radio set.

(b) The green pilot lamp should be lit and all tube filaments should be energized. To check filaments, unlock the drawer assembly and slide the drawer out or lift the top of the housing. After making this check keep the radio set open for the following checks.

(3) Check Receiver

(a) Meter Readings

Check receiver meter readings against the STAGE MEASUREMENT CHART in the RECEIVER section (noise input readings only). Use the Motorola portable test set or equivalent 0-50 microamp. test meter. The cable of the portable test set plugs directly into the metering socket of the receiver chassis. Check meter readings in the various test positions as indicated on the chart. If any of the readings are beyond the given limits, re-align the receiver as described in the RECEIVER section.

(b) Check for Normal Operation

With the receiver properly aligned, the dc input applied to the equipment and the antenna connected, the receiver should be in full operation. Check for proper operation as follows: Turn the VOLUME control to the full clockwise position. Turn the SQUELCH control to the full counterclockwise position (open). You should hear either a loud, rushing noise in the speaker or signals from any on-frequency station which may be on the air at this time. In the absence of any received signals the loud, rushing noise is a normal indication of receiver operation with "open" squelch.

(c) To Set the VOLUME Control

There are two controls involved in adjusting the audio level to the speaker. These controls must be adjusted in the presence of a normal, fully deviated signal from the base station transmitter (or other mobile located at an average distance). To adjust these controls proceed as follows:

With a signal being received, set the VOLUME control on the control head to maximum volume (fully clockwise). Then adjust the audio level control on the receiver chassis to a setting just below the point where distortion becomes audible. Now, reset the control head VOLUME control for the desired listening level.

The use of two controls in the audio circuits permits future readjustment of the speaker level at the control head without resetting the receiver audio level control.

(d) To Set the SQUELCH Control

Turn the SQUELCH control in the clockwise direction until the noise is squelched (cuts out).

(4) FCC Regulations

The operation of the transmitter in this radio set is covered by FCC rules and regulations. Several provisions of these rules are briefly summarized in this paragraph. For complete information, refer to the current FCC regulations covering the applicable type of service and equipment. FCC regulations excerpts:

(a) Transmitter frequency and deviation must be checked before a transmitter is placed in service and at least every six months thereafter. A suitable procedure shall be employed to ascertain that the transmitter is on the assigned carrier frequency and that the transmitter crystal actually controls the frequency of the radiation. Modulation deviation is limited to ±15 kc for 40 kc, 60 kc and 120 kc channel spacing operation and to ±5 kc for 20 kc and 30 kc channels.

(b) The rf power output of a transmitter shall be no more than required for satisfactory technical operation considering the conditions of its use.

(c) Only duly authorized radio operators or personnel working directly under their supervision may tune or adjust a radio transmitter.

(5) Check Transmitter

(a) Operational Check

The transmitter must be checked for proper operation before the equipment can be placed in service. Connect a dummy load lamp, rf wattmeter or the regular mobile radio set antenna to the ANTENNA receptacle on the front panel. Set the HI-LO switch on the power supply chassis to the HI position. Press the microphone push-to-talk button momentarily and listen for relay operation. The transmit-receive relay on the power supply chassis and the antenna relay on the transmitter chassis must operate. Check for indication of rf power output. The dummy load lamp should glow or the rf wattmeter, if used, will show the rf power output. If the regular mobile antenna is used, the transmitter should radiate signals to receivers of other sets on the same frequency.

CAUTION

Do not key the transmitter more than a few seconds at a time while making these operational tests.

If the operational test is satisfactory, proceed to the next step. If there is no indication of rf output, some troubleshooting must be done before proceeding. The simplified functional diagram in this section shows the overall operation of the radio set and gives the step-by-step sequence of operations. The intercabling diagrams trace the various circuits from chassis-to-chassis. Schematic diagrams of each chassis are included in the various sections of the manual. With these diagrams, the technician can understand how the radio set works and can isolate troubles to a specific chassis or stage thereof.

(b) Meter Readings

Refer to the alignment procedure in the TRANSMITTER section of this manual. With the HI-LO switch in the HI position check meter readings against the values given in the FINAL METER READINGS CHART. The transmitter must be keyed to obtain readings. Use the microphone push-to-talk button or the switch on the Motorola portable test set. To check readings consult the chart and set the switch to a given position. Then key the transmitter just long enough to observe the reading. Readings can be taken in any order. If the readings in positions 2, 3, 4, 5 or 6 are below the minimum values given, re-align the transmitter as described in the alignment procedure. The reading in the PA position is not too important at this point, however, if it is above the maximum value given, do not key the transmitter any more than absolutely necessary.

It is advisable to follow the complete alignment procedure at this point, since the next step requires a repeak of the transmitter adjustments to obtain full rf output.

(c) Loading to Antenna

Set the HI-LO switch to LO and load the transmitter to the antenna as described in the last three steps of the alignment procedure.

d. Deviation Check

FCC regulations require a deviation check before a transmitter is placed in service. This check is described in the TRANSMITTER section.

2. OPERATOR'S INSTRUCTIONS

a. To Turn "ON" Equipment:

Place the ON-OFF switch in the ON position. The green indicator will become illuminated. The receiver is now in full operation and the transmitter filaments are "on".

NOTE

If multi-channel transmitter and/or receiver is used, place frequency selector switch in desired frequency position.

b. To Receive:

(1) Turn the VOLUME control to the full clockwise position.

(2) Turn the SQUELCH control to the full counterclockwise position.

(3) Adjust the SQUELCH control, by turning the control slowly clockwise until the noise is just squelched (cuts out). Turning the control beyond this point will increase the minimum signal necessary to open the squelch circuit.

(4) Set the control head VOLUME control to the desired speaker level with a received signal.

c. To Transmit:

(1) Remove the microphone from the hanger bracket and press the push-to-talk button. The red indicator lamp will become illuminated, indicating the transmitter is "on". If a military or noise cancelling type microphone is used, hold the microphone at approximately a 30° angle from the lips and speak clearly and distinctly across the microphone in a normal or loud voice. If a handset microphone is used, speak directly into the mouthpiece of the handset. The TRANSMITTER CANNOT BE OVER-MODULATED BY SPEAKING LOUDLY.

(2) To receive reply, release the push-to-talk button. The red indicator lamp will go "off" indicating that the transmitter circuits are no longer energized. The received reply may now be heard over the speaker and/or the handset earpiece (if used).

(3) When the transmission is completed, release the push-to-talk button and hand the microphone on the hanger bracket.

d. To Turn "OFF" the Equipment:

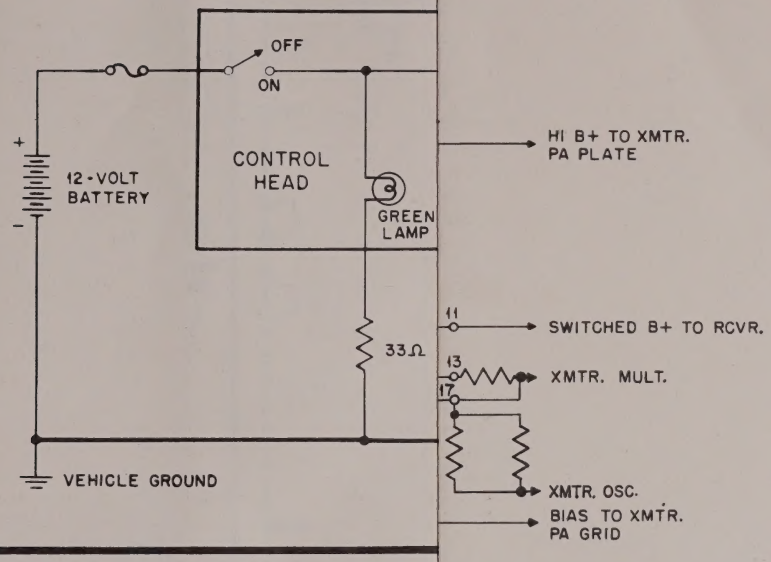
Place the ON-OFF switch in the OFF position. The green lamp will be turned "off".

3. CIRCUIT DESCRIPTION

The operation of the radio set as a whole is illustrated in the simplified functional diagram in this section. Refer first to the SEQUENCE OF OPERATIONS table for the various steps, then to the components as identified on the diagram. The diagram applies to both front-mount installations and rear-mount installations. The only differences between these two types of installations are in the control head and dc input circuit. The power supply, transmitter and receiver are the same for both installations.

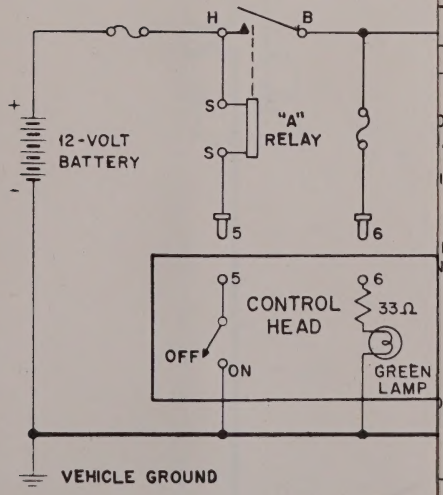
Once the simplified diagram is clearly understood refer to the POWER SUPPLY section of this manual for full information on the transistor multivibrator and relay action. For detailed description of the transmitter and receiver, refer to the TRANSMITTER and RECEIVER sections. For exact intercabling connections between the various chassis, refer to the intercabling diagrams in this section.

FRONT MOUNT INSTALLATIONS



TACTS

REAR MOUNT INSTALLATIONS



OF OPERATIONS

	"TURN-OFF" OPERATION
	1. P-T-T BUTTON RELEASED. 2. TRANSMIT-RECEIVE RELAY AND ANTENNA RELAY RELEASES. 3. TRANSMITTER OFF, RECEIVER BACK IN OPERATION. RED LIGHT GOES OUT ("STANDBY" CONDITION.

"T-Power" Mobile FM Two-Way Radio, 144-174 MC
Simplified Functional Diagram
Motorola No. 63E856642-B
11/3/59-RCS

c. To Transmit:

(1) Remove the microphone from the hanger bracket and press the push-to-talk button. The red indicator lamp will become illuminated, indicating the transmitter is "on". If a military or noise cancelling type microphone is used, hold the microphone at approximately a 30° angle from the lips and speak clearly and distinctly across the microphone in a normal or loud voice. If a handset microphone is used, speak directly into the mouthpiece of the handset. The TRANSMITTER CANNOT BE OVER-MODULATED BY SPEAKING LOUDLY.

(2) To receive reply, release the push-to-talk button. The red indicator lamp will go "off" indicating that the transmitter circuits are no longer energized. The received reply may now be heard over the speaker and/or the handset earpiece (if used).

(3) When the transmission is completed, release the push-to-talk button and hand the microphone on the hanger bracket.

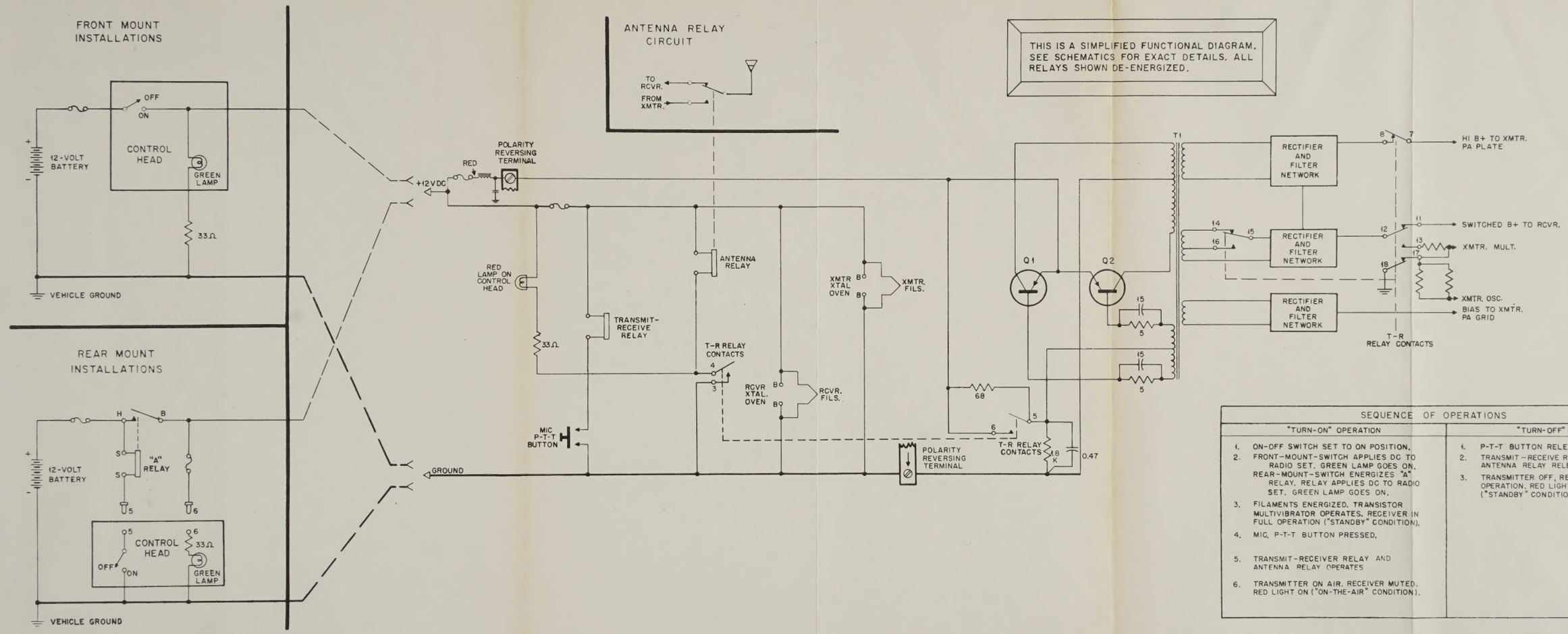
d. To Turn "OFF" the Equipment:

Place the ON-OFF switch in the OFF position. The green lamp will be turned "off".

3. CIRCUIT DESCRIPTION

The operation of the radio set as a whole is illustrated in the simplified functional diagram in this section. Refer first to the SEQUENCE OF OPERATIONS table for the various steps, then to the components as identified on the diagram. The diagram applies to both front-mount installations and rear-mount installations. The only differences between these two types of installations are in the control head and dc input circuit. The power supply, transmitter and receiver are the same for both installations.

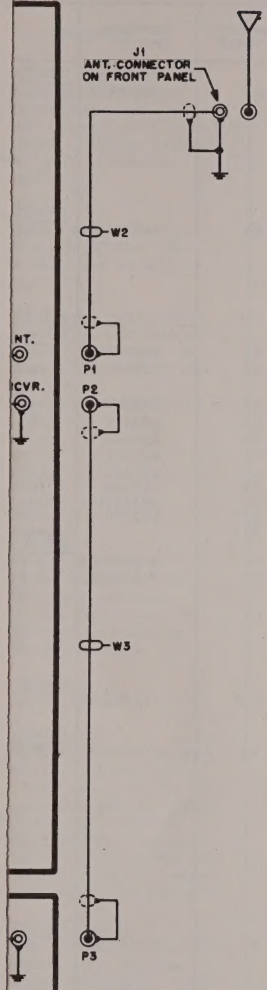
Once the simplified diagram is clearly understood refer to the POWER SUPPLY section of this manual for full information on the transistor multivibrator and relay action. For detailed description of the transmitter and receiver, refer to the TRANSMITTER and RECEIVER sections. For exact intercabling connections between the various chassis, refer to the intercabling diagrams in this section.



SEQUENCE OF OPERATIONS

"TURN-ON" OPERATION	"TURN-OFF" OPERATION
1. ON-OFF SWITCH SET TO ON POSITION.	1. P-T-T BUTTON RELEASED.
2. FRONT-MOUNT-SWITCH APPLIES DC TO RADIO SET, GREEN LAMP GOES ON. REAR-MOUNT-SWITCH ENERGIZES "A" RELAY, RELAY APPLIES DC TO RADIO SET, GREEN LAMP GOES ON.	2. TRANSMIT-RECEIVE RELAY AND ANTENNA RELAY RELEASES.
3. FILAMENTS ENERGIZED, TRANSISTOR MULTIVIBRATOR OPERATES, RECEIVER IN FULL OPERATION ("STANDBY" CONDITION).	3. TRANSMITTER OFF, RECEIVER BACK IN OPERATION, RED LIGHT GOES OUT ("STANDBY" CONDITION.
4. MIC. P-T-T BUTTON PRESSED.	
5. TRANSMIT-RECEIVER RELAY AND ANTENNA RELAY OPERATES	
6. TRANSMITTER ON AIR, RECEIVER MUTED, RED LIGHT ON ("ON-THE-AIR" CONDITION).	

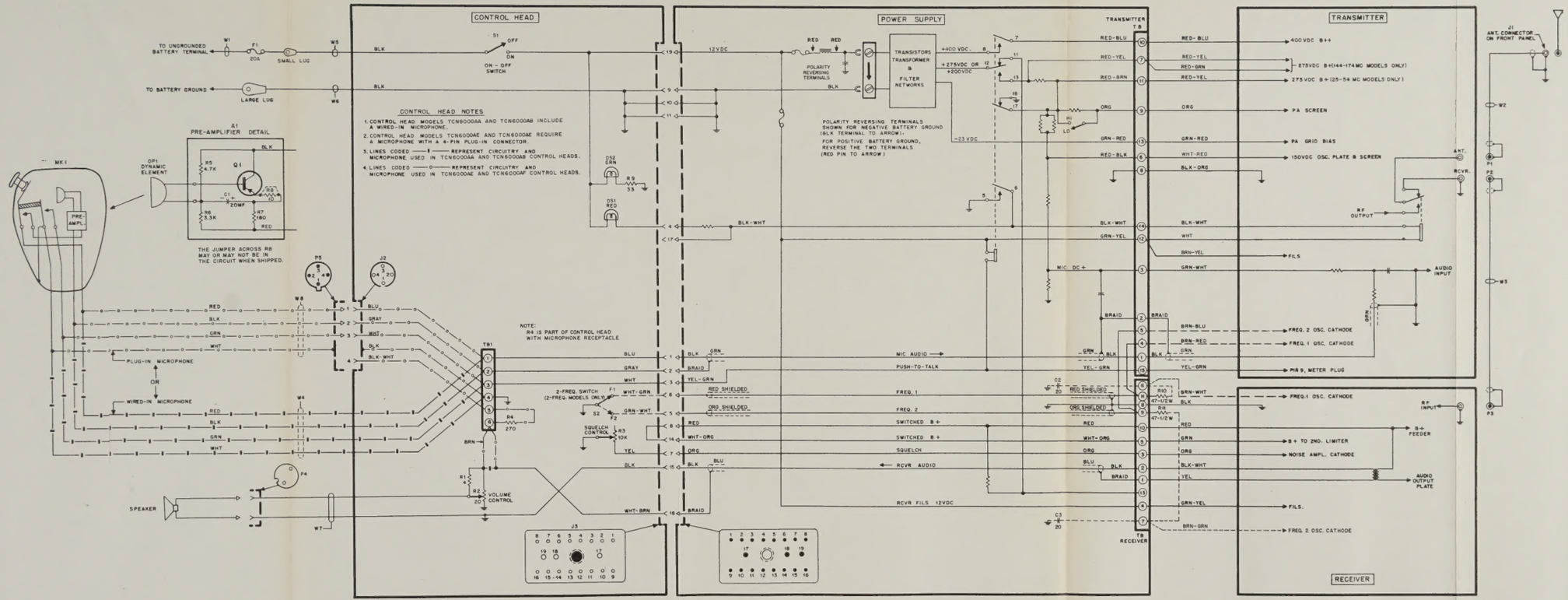
"T-Power" Mobile FM Two-Way Radio, 144-174 MC
Simplified Functional Diagram
Motorola No. 63E856642-B
11/3/59-RCS



REVISIONS

DIAG. ISSUE	CHASSIS SUFFIX	REF. SYMBOL	CHANGE	LOCATION
A			TLN6155A 2-FREQ. RCVR. FILTER KIT ADDED	RCVR. TERM. BOARD ON POWER SUPPLY
B			MINOR REVISIONS IN POWER SUPPLY	

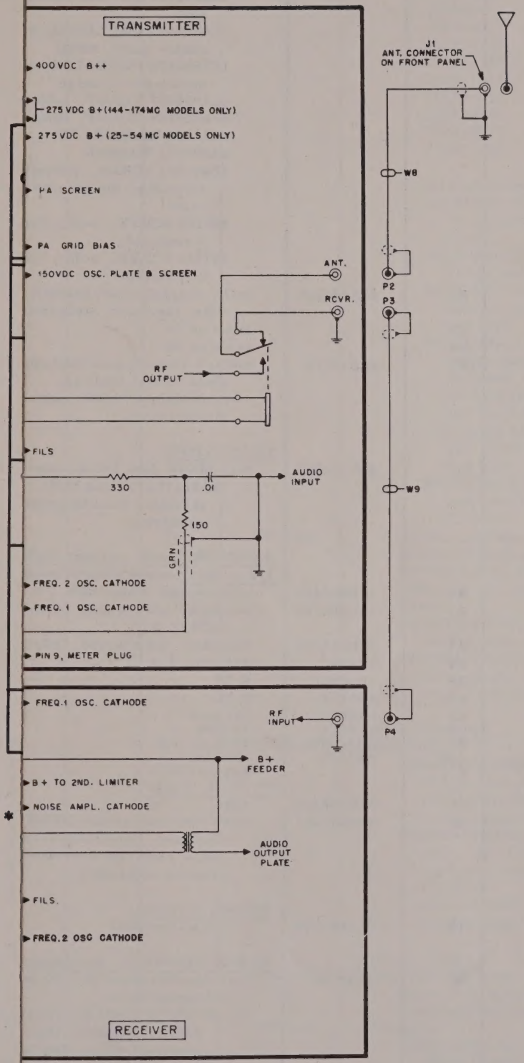
Front Mount Radio Set
Intercabling Diagram
Motorola No. 63E856643-B
11/3/59-RCS



REVISIONS

DIAG. ISSUE	CHASSIS SUFFIX	REF. SYMBOL	CHANGE	LOCATION
A			TLN6159A 2-FREQ. RCVR. FILTER KIT ADDED	RCVR. TERM. BOARD ON POWER SUPPLY
B			MINOR REVISIONS IN POWER SUPPLY	

Front Mount Radio Set
Intercabling Diagram
Motorola No. 63E856643-B
11/3/59-RCS



REVISIONS

DIAG. ISSUE	CHASSIS SUFFIX	REF. SYMBOL	CHANGE	LOCATION
A			TLN6155A 2-FREQ. RCVR. FILTER KIT ADDED	RCVR. TERM. BOARD ON POWER SUPPLY
B			MINOR CHANGES IN POWER SUPPLY	

EPD-1516-O

Rear Mount Radio Set
Intercabling Diagram
Motorola No. 63E856644-B
11/3/59-RCS

PARTS LIST for Intercabling Diagram 63E856643-B

NOTE

Reference symbols using the initial letter "X" (XV1, etc.) denote the mounting for "plug-in" components. Thus, "XV1" is the socket for tube V1, etc.

REFERENCE SYMBOL	MOTOROLA PART No.	DESCRIPTION
		AMPLIFIER, AF:
A1	1V861317	microphone pre-amplifier: assembly; includes: 1V859594 BOARD, printed circuit; assembly; includes soldering lug terminals Reference parts C1, Q1, R5, R6, R7, R8
		CAPACITOR, fixed: electrolytic;
C1	23C855013 or 23B844927	tubular; 20 uf +100-10%; 25 vdcw
C2	23C855013	tubular; 20 uf +100-10%; 25 vdcw
C3		same as C2
		CARTRIDGE, microphone:
DP1	59C852603	magnetic; dynamic type; 175 ohm impedance at 1 kc
		LAMP, incandescent:
DS1	65R4151	6-8 volt; .2 ampere; single contact bayonet base; globular glass; type 51
DS2		same as DS1
		FUSE, cartridge: one time; paper:
F1	65K82482	20 ampere; 250 volt; 2" long x 9/16" diameter
		CONNECTOR, receptacle: female;
J1	1V855055	assembly: includes mounting bracket and single contact, coaxial connector
J2	9B16345	4 contact; polarized; round molded black phenolic base; chassis mounted; includes: 4S7699 LOCKWASHER: 13/16" internal 2K81180 NUT, ring
J3	9C801050	19 contact; polarized; rectangular molded black phenolic base; chassis mounted; does not include 7B855113 BRACKET, connector mounting, nor 64C855103 PLATE, connector mounting; bracket and plate must be ordered separately
		MICROPHONE, dynamic:
MK1	TU353A ("plug-in")	palm type; contains transistor amplifier and "push-to-talk" switch; includes reference parts A1, DP1, W8
	or 1V852400 ("wired-in")	palm type; contains transistor amplifier and "push-to-talk" switch; includes reference parts A1, DP1, W4
		CONNECTOR, plug:
P1	28A474006	male; single contact; round bakelite wafer insulator; cable mounted; connects to Transmitter Antenna Relay Antenna Connector
P2		same as P1 except connects to Transmitter Antenna Relay Receiver Connector
P3		same as P1 except connects to Receiver Antenna Connector

REFERENCE SYMBOL	MOTOROLA PART No.	DESCRIPTION
		CONNECTOR, plug: (continued)
P4	9B855112	2 contact; polarized; round phenolic wafer insulator; cable mounted; does not include 15B855111 SHELL, connector; shell must be ordered separately
		TRANSISTOR:
Q1	48K124317	type MN60; does not include 14A861196 INSULATOR; insulator must be ordered separately
		RESISTOR, fixed: carbon; ±10%; 1/2 w; ins.; unless otherwise stated
R1	17K892469	wire-wound; 4 ohm ±2%; 1 w
R2	18K855108	variable: wire-wound; 20 ohm ±20%; 2 w
R3	18K855107	variable: wire-wound; 10K; 2 w
R4	6R6336	270 ohm; 1 w
R5	6R6080	4.7K
R6	6R5581	3.3K
R7	6R5660	180 ohm
R8	6R5621	10 ohm
R9	6R488016	33 ohm; 2 w
R10	6R5550	47 ohm
R11		same as R10
		SWITCH, toggle:
S1	40B858304	S. P. S. T.
S2	40A80248	S. P. D. T.; does not include 2S8382 NUT, machine: 15/32-32 x 9/16" hex; 2 required; nuts must be ordered separately
		BOARD, terminal:
TB1	31A890699	6 screw terminals
		LEAD, electrical:
W1	1V832063	Battery to Fuseholder; includes: 30K831572 CABLE, power: single conductor; #10 ga.; stranded; ins; coded BLK; 2 ft. length required 29K832116 LUG, ring tongue: for 3/8" stud and #10 wire 29K824154 LUG, ring tongue: for #10 stud and #10 wire
		LINE, RF transmission:
W2	1V855053	assembly, Antenna to Transmitter Antenna Relay; includes: 1V855054 ASSEMBLY, cable and plug: includes: 30B475378 CABLE, RF: coaxial; RG-58A/U; 6" length required Reference part P1 Reference part J1
W3	1K800193	Transmitter Antenna Relay to Receiver Antenna Input; includes: 30B475378 CABLE, RF: coaxial; RG-58A/U; 24" length required Reference parts P2, P3
		CORD, microphone:
W4	1V854006	assembly; includes: 30K852742 CORD, coiled; tinsel 41A852707 SPRING, strain relief 11M2506 TUBING, extruded, #9 BLK; 1" length required 29A847033 LUG, terminal; wire mounted; insulation piercing; 8 required

REFERENCE SYMBOL	MOTOROLA PART No.	DESCRIPTION
		CABLE, power:
W5	30K831572	single conductor; #10 ga. stranded; insulated; coded black; 9 ft. length required does not include 29K824154 LUG, ring tongue: for #10 wire and #10 stud; lug must be ordered separately
W6		same as W5 except does not include 29K832116 LUG, ring tongue; for #10 wire and 3/8" stud; lug must be ordered separately
W7	30A825430	2 conductor; rubber covered; each conductor; #18 ga. stranded; 41" length required
W8	1V854034	assembly; includes: 30K852742 CORD, coiled; tinsel 41A852707 SPRING, strain relief 11M2506 TUBING, extruded; #9 BLK; 2" length required 29A847033 LUG, terminal; wire mounted; insulation piercing; 4 required 29A847034 LUG, terminal; wire mounted; insulation piercing; 4 required 37K480513 SLEEVE, rubber Reference part P5
		LAMPHOLDER:
XDS1	9A859619	single contact; miniature; bayonet base
XDS2		same as XDS1
		FUSEHOLDER: single fuse mounting
XF1	67K892616	rectangular porcelain base; chassis mounted; for fuse 2" long x 9/16" diameter

NON-REFERENCED ITEMS

TLN6000A Installation Kit, includes:

1V859627	Cable Clamp Kit: includes: 42A19376 CLAMP, cable: 4 req'd 3S7467 SCREW, tapping: #8 x 3/8" plain hex; 4 required
1V849628	Mounting Hardware Kit: includes: 3S125947 SCREW, tapping: #14 x 3/4" plain hex; 4 required 4S119331 LOCKWASHER: 1/4" split; 4 required
1V84019	Noise Filter Kit: includes: 8A821889 CAPACITOR, generator hash filter: fixed: paper; tubular; .5 uf ±20%; 150 vdcw; one lead grounded; one lead insulated; 2 supplied 6A4141 SUPPRESSOR, noise: resistor; screw type 4S7670 LOCKWASHER: 1/4" internal; 2 required

TK611 Cable Kit, includes:

	Reference parts F1, XF1, W1
32A880952	GASKET, fuseholder
1V474596	Mounting Hardware Kit, fuseholder: includes: 4A83863 WASHER, cushion: 2 supplied 3S400465 SCREW, tapping: #10 x 3/4" slotted round head; 2 supplied

REFERENCE SYMBOL	MOTOROLA PART No.	DESCRIPTION
		Mounting Hardware Kit, (continued) 4S7658 LOCKWASHER: #10 internal; 2 supplied 4S1706 WASHER: 3/8" x .203 x .033"; 2 supplied

Microphone, includes:

	Items used in both "wired-in" microphone and "plug-in" microphone Reference part A1
1V854005	BACK HOUSING AND HANG-UP STUD ASSEMBLY
40B857174	SWITCH, push
3S124693	LOCKSCREW: 6-32 x 1/4"; Phillips round head; 3 required
42A852710	STRAP, strain relief
38A852699	BUTTON, push
15D852566	FRONT HOUSING
13B852703	GRILLE
35A852701	CLOTH, grille
13A852709	EMBLEM, MOTOROLA trade mark
32B852702	GASKET, rubber
14A857138	INSULATOR: used for insulating printed circuit assembly
42A852705	CLAMP, used for securing microphone cartridge
14A857137	INSULATOR: used between clamp and microphone cartridge
4K852762	WASHER, insulating; used as a spacer
3S127924	LOCKSCREW: 6-32 x 5/16"; Phillips round head
3S127481	SCREW, machine: 6-32 x 7/8"; Phillips round head; 2 required
4S400386	LOCKWASHER: #6 split; 2 required
	Items used in 1V852400 "wired-in" microphone only Reference part W4
33K852697	NAMEPLATE: Model Identification
	Items used in TU353A "plug-in" microphone only Reference part W8
33K852698	NAMEPLATE: Model Identification
1V16241	Mounting Kit, microphone: includes: 64A85596 PLATE, support: for microphone hang-up 3S122830 SCREW, tapping: #8 x 1/2"; 2 required

Control Head

Each control head model includes the items shown for the model, plus items which are common to all.

	TGN6000AA (1-freq. with "wired-in" microphone); includes the following items:
1V852400	MICROPHONE (reference part MK1)
13D859614	ESCUTCHEON
38A857093	BUTTON, plug
37K106352	GROMMET, rubber; for 7/16" diameter hole
1V16241	MOUNTING KIT, microphone: includes: 64A85596 PLATE, support: for microphone hang-up 3S122830 SCREW, tapping: #8 x 1/2"; 2 required

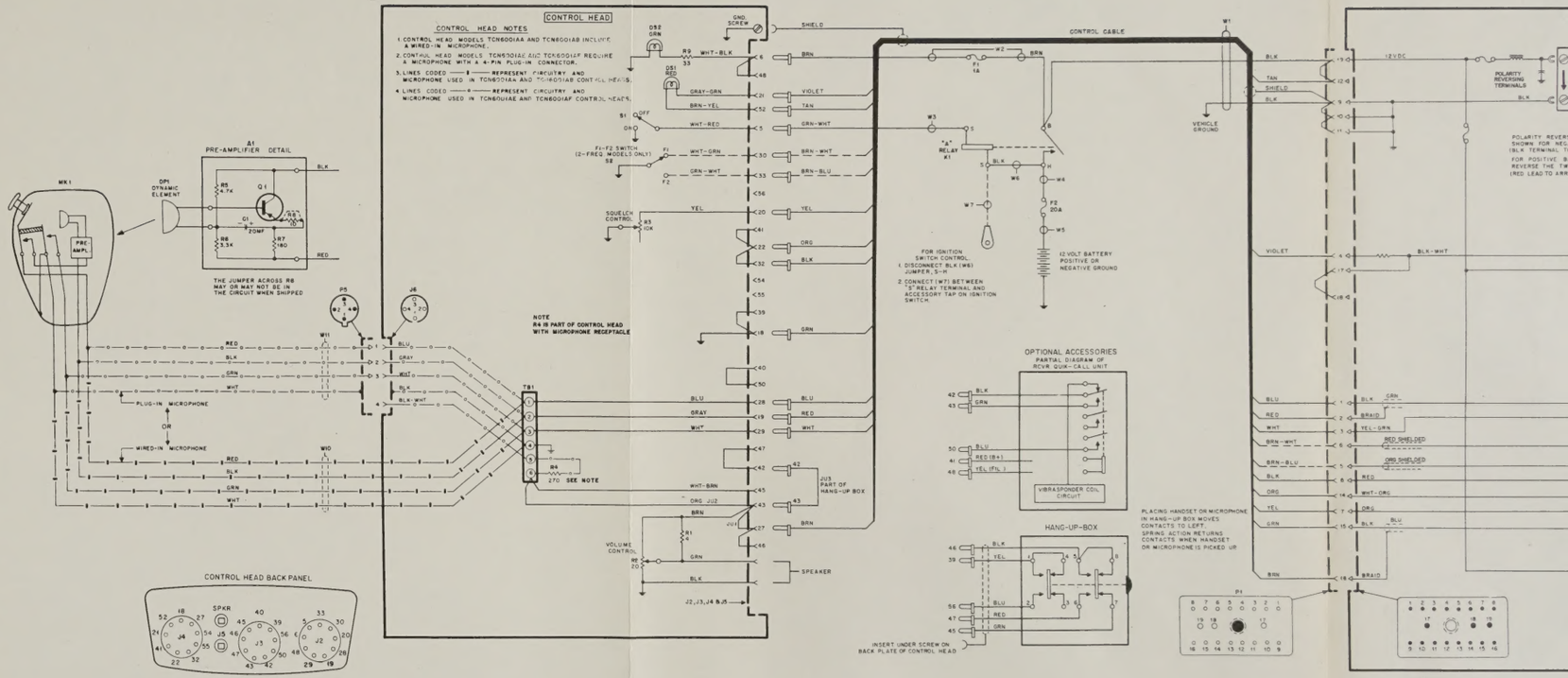
REFERENCE SYMBOL	MOTOROLA PART No.	DESCRIPTION
		TGN6000AB (2-freq. with "wired-in" microphone); includes reference part S2 and the following items:
	1V852400	MICROPHONE (reference part MK1)
	13D859615	ESCUTCHEON
	38A857093	BUTTON, plug
	37K106352	GROMMET, rubber: for 7/16" diameter hole
	1V16241	MOUNTING KIT, microphone: includes: 64A85596 PLATE, support: for microphone hang-up 3S122830 SCREW, tapping: #8 x 1/2"; 2 required
		TGN6000AE (1-freq. with receptacle for "plug-in" microphone); includes reference parts J2, R4 and the following items:
	13D859614	ESCUTCHEON
	4S7691	LOCKWASHER: 3/8" internal
	29R5279	LUG, soldering: 7/8"
		TGN6000AF (2-freq. with receptacle for "plug-in" microphone): includes reference parts J2, R4, S2 and the following items:
	13D859615	ESCUTCHEON
	4S7691	LOCKWASHER: 3/8" internal
	29R5279	LUG, soldering: 7/8"
		Items common to all control heads Reference parts DS1, DS2, J3, P4, S1, TB1, W5, W6, W7, XDS1, XDS2
	2S8382	NUT, machine: 15/32-32 x 9/16" hex; 2 required
	61B859620	LENS, indicator: RED
	61K859621	LENS, indicator; GRN
	4S7691	LOCKWASHER: 3/8" internal
	2S8364	NUT, machine: 3/8-32 x 1/2" hex; 2 required
	64C855103	PLATE, connector mounting (back cover)
	7B855113	BRACKET, connector mounting
	42A855115	CLAMP, cable
	26B857812	SHIELD, indicator lamp: 2 req'd
	3S122080	LOCKSCREW: 6-32 x 1/4" plain hex; 6 required
	36B855027	KNOB, control: 2 required

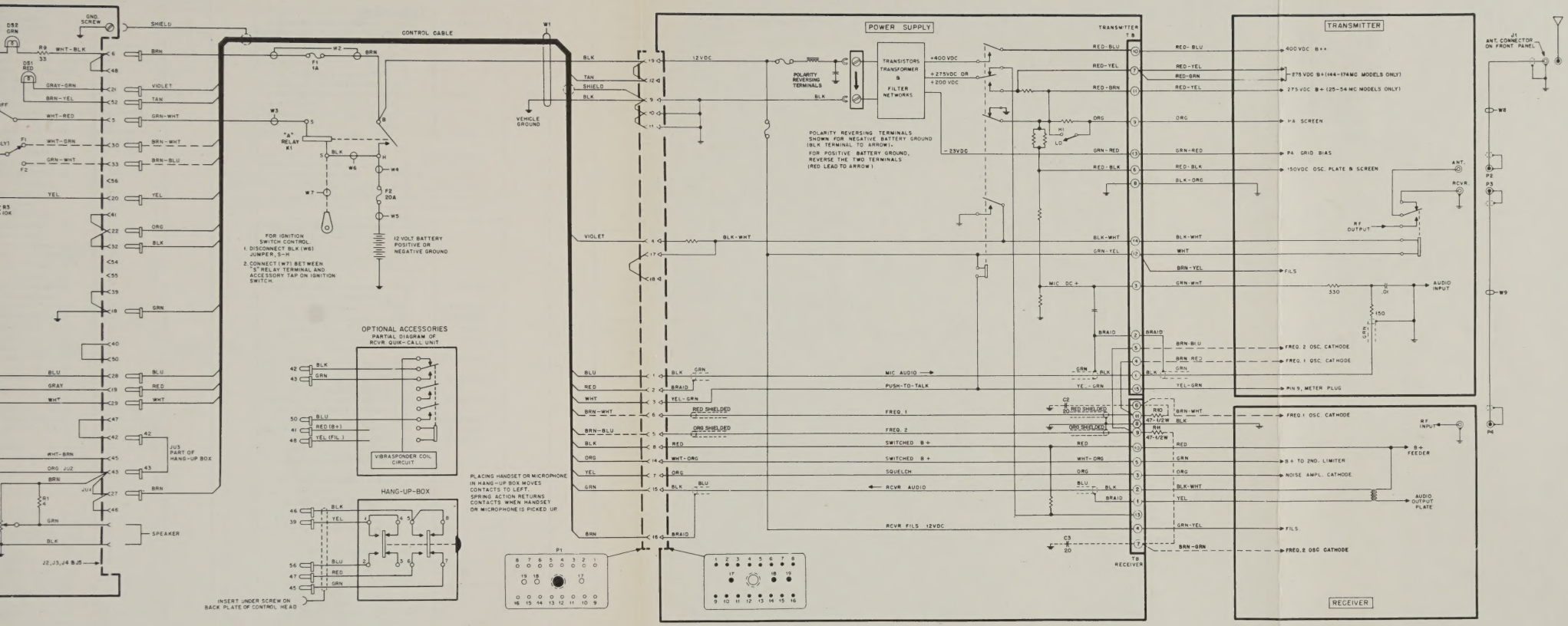
EPD-1516-O

CONTROL HEAD JUMPER TABLE

CASE NO.	EQUIPMENT USED*				CIRCUIT OPERATION	JUMPERS		
	MIC.	HANDSET	HANG-UP BOX	QUIK-CALL		JU1	JU2	JU3
1	EITHER		---	---	Basic operation. Radio Set Speaker in circuit at all times	USED	USED	OMIT
2	---	X	X	---	Handset picked up connects audio to handset earpiece	OMIT	OMIT	USED
					Handset picked up connects audio to handset earpiece, speaker in circuit.	USED	OMIT	USED
3	X	---	X	X	Audio to speaker when microphone is removed or hung up. Alarm circuit energized. "Quik-call" disabled.	OMIT	USED	OMIT
4	---	X	X	X	Audio switched from speaker to handset earpiece. Alarm circuit energized	OMIT	OMIT	OMIT
					Audio switched from "quik-call" to speaker and handset. Alarm circuit energized.	OMIT	USED	OMIT
5	EITHER		---	X	"Quik-call" used for alarm purposes only. Audio to speaker at all times.	USED	USED	OMIT

* X = item used
--- = item not used



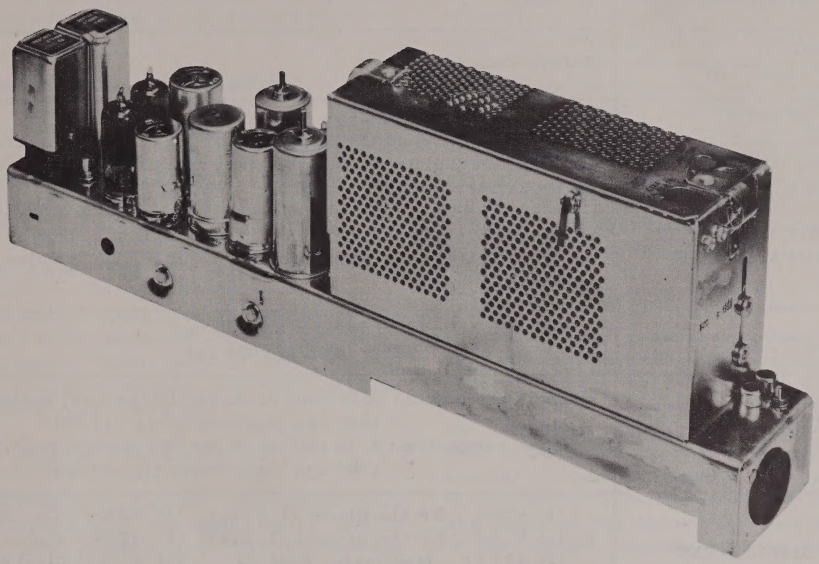


REVISIONS

DIAG. ISSUE	CHASSIS SUFFIX	REF. SYMBOL	CHANGE	LOCATION
A			TLN6155A 2-FREQ. RCVR. FILTER KIT ADDED	RCVR. TERM. BOARD ON POWER SUPPLY
B			MINOR CHANGES IN POWER SUPPLY	

Rear Mount Radio Set
Intercabling Diagram
Motorola No. 63E856644-B
11/3/59-RCS

AEPD-1696 (CE1135-B) (CE1317-A)



MODEL TTD1060 TRANSMITTER

MODEL CHART

MODEL NUMBER	NO. OF FREQS.	CRYSTALS REQUIRED
TTD1060AA	ONE	ONE RN1-A
TTD1060AB	TWO	TWO RN1-A

1. DESCRIPTION

The transmitters listed in the model chart are FM transmitters which operate on crystal-controlled frequencies within the 144-174 mc band. A separate power supply provides the transmitter operating voltages to produce an rf power output of 25 watts.

The single-frequency transmitter consists of a crystal-controlled oscillator, an angular phase modulator, four stages of frequency multiplication and a final amplifier stage. The fundamental crystal frequency is multiplied 24 times to provide the final rf amplifier output frequency.

The two-frequency transmitter is the same as the single frequency model except that a second crystal oscillator, with control crystal, is used. Transmissions are made on two specific crystal-controlled frequencies in the 144-174 mc band. Only one frequency can be transmitted at a time. An external switch is required for changing frequencies and is ordinarily incorporated into the control unit used with the transmitter. This switch causes the desired oscillator to function by grounding its cathode.

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Engineering Publications 4501 W. Augusta Blvd. Chicago 51, Illinois

PARTS LIST for Intercabling Diagram 63E856644-B

REFERENCE SYMBOL	MOTOROLA PART No.	DESCRIPTION
		AMPLIFIER, AF:
A1	1V861317	microphone pre-amplifier: assembly, includes: 1V859594 BOARD, circuit: eyeleted; assembly; includes soldering lug terminals Reference parts C1, Q1, R5, R6, R7, R8
		CAPACITOR, fixed: electrolytic:
C1	23C855013 or 21B844927	tubular; 20 uf +100-10%; 25 vdcw
C2 C3	23C855013	tubular; 20 uf +100-10%; 25 vdcw same as C2
		CARTRIDGE, microphone:
DP1	59C852603	magnetic; dynamic type; 175 ohm impedance at 1 kc
		LAMP, incandescent:
DS1	65R4151	6-8 volt; .2 ampere; single contact bayonet base; globular glass; type 51
DS2		same as DS1
		FUSE, cartridge:
F1	65R52281	one time; glass; 1 ampere; 250 v; 1-1/4" long x 1/4" dia.
F2	65K52482	one time; paper; 20 ampere; 250 v; 2" long x 9/16" dia.
		CONNECTOR, receptacle: female:
J1	1V855055	assembly: includes mounting bracket and single contact, coaxial connector
J2	9B855150	9 contact; polarized; round molded black phenolic insulator saddle mounted
J3		same as J2
J4		same as J2
J5	9K82810	2 contact; rectangular molded black bakelite insulator; chassis mounted
J6	9B16345	4 contact; polarized; round molded black phenolic base; chassis mounted; includes: 4S7699 LOCKWASHER: 13/16" internal ZK81180 NUT, ring
		LEAD, electrical: jumper:
JU1		for reference only
JU2		for reference only
JU3		for reference only
JU4		for reference only
		RELAY, armature:
K1	59K858480	12 v dc; contact arrangement, 1 form "A"; coil resistance 76.5-93.5 ohm
		MICROPHONE, dynamic:
MK1	TU353A ("plug-in")	palm type; contains transistor amplifier and "push-to-talk" switch; includes reference parts A1, DP1, W11
	or 1V852400 ("wired-in")	palm type; contains transistor amplifier and "push-to-talk" switch; includes reference parts A1, DP1, W10
		CONNECTOR, plug:
P1	9C801050	female; 19 contact; polarized; rectangular; molded mica filled phenolic base; cable mounted; connects to Power Supply; does not include the following

REFERENCE SYMBOL	MOTOROLA PART No.	DESCRIPTION
		CONNECTOR, plug: (continued) component parts which must be ordered separately: 15B800676 SHELL, connector 15B800674 COVER, connector shell 14A800673 INSULATOR, connector shell: small 14B800678 INSULATOR, connector shell: large 42A800667 CLAMP, cable 42A800669 CLAMP, cable 4A11722 WASHER, "C" 4A800671 WASHER 3B800681 SCREW, connector retaining: includes knurled knob 3S7209 SCREW, 6-32 x 1/8; 2 required 3S7162 SCREW, 6-32 x 1/2; 2 required
P2	28A474006	male; coaxial; round bakelite wafer insulator; cable mounted
P3		same as P2
P4		same as P2
P5	28A16370	male; 4 contact; polarized; includes metal shell and 41K838823 SPRING, cable strain relief
		TRANSISTOR:
Q1	48A124317	type MN60; does not include 14A861196 INSULATOR: insulator must be ordered separately
		RESISTOR, fixed: carbon; ±10% 1/2 w; ins.; unless otherwise stated
R1	17K892469	wire-wound; 4 ohm ±2%; 1 w
R2	18K855108	variable; wire-wound; 20 ohm ±20%; 2 w
R3	18K855107	variable; wire-wound; 10K; 2 w
R4	6R6336	270 ohm; 1 w
R5	6R6080	4.7K
R6	6R5581	3.3K
R7	6R5660	180 ohm
R8	6R5621	10 ohm
R9	6R488016	33 ohm; 2 w
R10	6R5550	47 ohm
R11		same as R10
		SWITCH, toggle:
S1	40B858304	spst
S2	40A80248	spdt; does not include 2S8382 NUT, machine: 15/32-32 x 9/16" hex; 2 required; nuts must be ordered separately
		BOARD, terminal:
TB1	31A890699	6 screw terminals
		CABLE ASSEMBLY, special purpose:
W1	1V832061	includes reference part P1 and the following items: 30C830032 CABLE: 12 conductor; stranded, ins.; leads; shielded; black plastic covered; 17 ft. length req'd. 20K890418 CONNECTOR, plug male; single contact; pin type; cable mounted; coded #18 also includes the following connectors which are the same as above part number 29K890418 except for coding as indicated:

REFERENCE SYMBOL	MOTOROLA PART No.	DESCRIPTION
		CABLE ASSEMBLY, special purpose (continued)
		Part No. / Code #
		29K890419 19
		29K890420 20
		29K890421 21
		29K890422 22
		29K890427 27
		29K890428 28
		29K890429 29
		29K890430 30
		29K890432 32
		29K890433 33
		29K835340 52
		also includes: 42A893468 CLAMP, cable; "wrap around"; strain relief 42A893464 HOOK, "S"; strain relief 29A824151 LUG, slotted tongue: for #10 stud and #10 wire 30K831572 CABLE, power: single conductor; stranded; insulated; coded BLK; one 17 ft. and one 4 ft. length req'd 29K824154 LUG, ring tongue: for #10 stud and #10 wire 29K830073 LUG, ring tongue: for 5/16" stud and #10 wire
W2	1V859441	assembly consisting of "in line" fuseholder with attached connecting leads: includes reference part XF1 and the following items: 29K824456 LUG, ring tongue: for #10 stud and #18 wire 29K890406 CONNECTOR, plug: male; single contact; pin type; coded #6
		LEAD, electrical: includes:
W3	1V859428	10M488285 WIRE, electrical: #20 ga.; stranded; ins.; coded GRN-WHT; 68" length required 29K890405 CONNECTOR, plug: male; single contact; pin type; cable mounted; coded #5 29K824456 LUG, ring tongue: for #10 stud and #20 wire
W4	42A858471	CABLE, power: consists of a brass strap 2-3/4" long x 5/8" wide x .015" thick; processed and plated
W5	1V859446	includes: 30K813233 CABLE, power: single conductor; #10 ga.; stranded; ins.; coded RED; 5 ft. length required 29K830073 LUG, ring tongue for 5/16" stud 29K824154 LUG, ring tongue for #10 stud

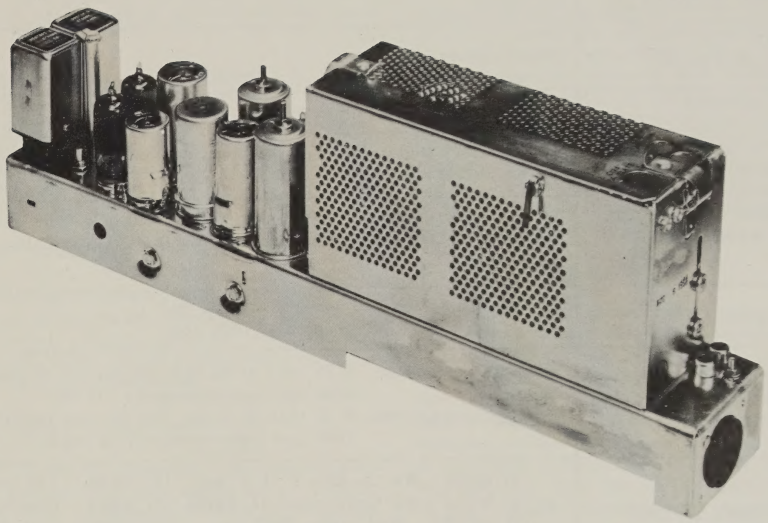
REFERENCE SYMBOL	MOTOROLA PART No.	DESCRIPTION
		LEAD, electrical:
W6	1V830177	Relay Jumper; includes: 10M370 WIRE, electrical: single conductor; #12 ga.; stranded; ins.; coded BLACK; 4" length req'd 29A824151 LUG, slotted tongue: for #10 stud and #12 wire; 2 req'd
W7	1V847414	Ignition Switch Control; includes: 10M430 WIRE, electrical: single conductor; #20 ga.; str.; ins.; coded BLACK; 5 ft. length required 29K824456 LUG, ring tongue 2 supplied
W8	1V813547	LINE, RF, transmission: coaxial; includes: 30B475378 CABLE, RF: coaxial; RG-58A/U; 5-1/2" length required; reference parts J1 and P2
W9	1K800193	coaxial; includes: 30B475378 CABLE, RF: coaxial RG-58A/U; 2 ft. length required; reference parts P3 and P4
		CORD, microphone:
W10	1V854006 ("wired-in" mic.)	includes: 30K852742 CORD, coiled; tinsel; 4 conductor 41A852707 SPRING, strain relief 11M2506 TUBING, extruded, #9 BLK; 1" length required 29A847033 LUG, terminal; wire mounted; insulation piercing; 8 required
W11	1V854034 ("plug-in" mic.")	includes: 30K852742 CORD, coiled; tinsel; 4 conductor 41A852707 SPRING, strain relief 11M9578 TUBING, extruded; #8 CLEAR; 2" length req'd 29A847033 LUG, terminal; wire mounted; insulation piercing; 4 required 29A847034 LUG, terminal; wire mounted; insulation piercing; 4 required 37K480513 SLEEVE, rubber Reference part P5
		NON-REFERENCED ITEMS
		The following are replaceable parts which do not appear on the intercabling diagram
XDS1	9A855117	LAMPHOLDER: single contact miniature bayonet base
XDS2		same as XDS1

REFERENCE SYMBOL	MOTOROLA PART No.	DESCRIPTION
		NON-REFERENCED ITEMS (cont'd)
XF1	9K847158	FUSEHOLDER: cable mounted; male and female retainer; single fuse mounting; includes #18 ga. wire leads, stranded, insulated, coded BRN; length 68" overall for 1-1/4" long x 1/4" dia fuse; includes ref. part F1
XF2	67K892616	chassis mounted; clip type; single fuse mounting; porcelain base; for 2" long x 9/16" diameter fuses
		Control Heads
		Items which are common to all control heads are listed first. Items which are not common to all control heads are listed under the model number of the particular control head concerned.
		Items common to all control heads include reference parts DS1, DS2, J2, J3, J4, J5, R1, R2, R3, R9, S1, TB1, XDS1, XDS2, plus the following:
2S8382		NUT, machine: 15/32-32 x 9/16" hex; 2 required
61B859620		LENS, indicator: RED
61K859621		LENS, indicator: GRN
4S7691		LOCKWASHER: 3/8" internal
2S8364		NUT, machine: 3/8-32 x 1/2" hex; 2 required
64A857162		PLATE, connector mounting (back cover)
3S122518		LOCKSCREW: 4-40 x 3/16" plain hex head; 2 required
3S124542		LOCKSCREW: 6-32 x 3/4" plain hex head; 4 required
36B855027		KNOB, control; 2 required
7B855239		BRACKET, control head mounting
1V859999		MOUNTING HARDWARE KIT: includes: 4K847649 WASHER, fiber: 2 required 4S7670 LOCKWASHER: 1/4" internal; 2 required 3S129304 SCREW, machine: 1/4-20 x 1/2" slotted oven head; 2 required
		Each control head model includes the items shown for the model, plus items which are common to all.
		TCN6001AA (1-freq. with "wired-in" microphone); includes the following items:
1V852400		MICROPHONE (reference part MK1)
13D859614		ESCUTCHEON
38A857093		BUTTON, plug
37K106352		GROMMET, rubber: for 7/16" diameter hole
1V16241		MOUNTING KIT, microphone: includes:

REFERENCE SYMBOL	MOTOROLA PART No.	DESCRIPTION
		NON-REFERENCED ITEMS (cont'd)
		64A85596 BRACKET, microphone hang-up
		3S122830 SCREW, tapping: #8 x 1/2" slotted binder head; 2 required
		TCN6001AB (2 freq. with "wired-in" microphone): includes reference part S2 and the following items:
1V852400		MICROPHONE (reference part MK1)
13D859615		ESCUTCHEON
38A857093		BUTTON, plug
37K106352		GROMMET, rubber: for 7/16" diameter hole
1V16241		MOUNTING KIT, microphone: includes: 64A85596 BRACKET, microphone hang-up 3S122830 SCREW, tapping: #8 x 1/2" slotted binder head; 2 required
		TCN6001AE (1-freq. with receptacle for "plug-in" microphone): includes reference parts J6, R4 and the following items:
13D859614		ESCUTCHEON
4S7691		LOCKWASHER: 3/8" internal
29R5279		LUG, soldering: 7/8"
		TCN6001AF (2-freq. with receptacle for "plug-in" microphone): includes reference parts J6, R4, S2 and the following items:
13D859615		ESCUTCHEON
4S7691		LOCKWASHER: 3/8" internal
29R5279		LUG, soldering: 7/8"
		Microphones
		Items common to both "wired-in" microphone and "plug-in" microphone include reference part A1 and the following:
1V854005		BACK HOUSING AND HANG-UP STUD ASSEMBLY
40B857174		SWITCH, push; dpst
3S124693		LOCKSCREW: 6-32 x 1/4"; Phillips round head; 3 req'd
42A852710		STRAP, strain relief
38A852699		BUTTON, push
15D852566		FRONT HOUSING
13B852703		GRILLE
35A852701		CLOTH, grille
13A852709		EMBLEM, MOTOROLA trade mark
32B852702		GASKET, rubber
14A857138		INSULATOR: used for insulating printed circuit assembly
42A852705		CLAMP, used for securing microphone cartridge

REFERENCE SYMBOL	MOTOROLA PART No.	DESCRIPTION
		NON-REFERENCED ITEMS (cont'd)
	14A857137	INSULATOR: used between clamp and microphone cartridge
	4K852762	WASHER, insulating; used as a spacer
	3S127924	LOCKSCREW: 6-32 x 5/16"; Phillips round head
	3S127481	SCREW, machine 6-32 x 7/8"; Phillips round head; 2 req'd
	4S400386	LOCKWASHER: #6 split; 2 req'd
		Items used in 1V852400 "wired-in" microphone only include reference part W10 and the following:
	33K852697	NAMEPLATE, model identification
		Items used in TU353A "plug-in" microphone only include reference part W11 and the following:
	33K852698	NAMEPLATE, model identification
1V16241		Mounting Kit, microphone: includes: 64A85596 BRACKET, microphone hang-up 3S122830 SCREW, tapping: #8 x 1/2" slotted binder head; 2 required
		TKN6006A Cable Kit
1V859447		includes reference parts F2, K1, W1 to W7, plus the following: INSTALLATION KIT: includes: 3S8153 SCREW, tapping: #8 x 3/4" plain hex head; 3 required 3S7542 SCREW, tapping: #8 x 3/8" slotted binder head; 4 required 42A19376 CLAMP, cable: 4 required 37K107234 GROMMET, rubber

AEPD-1696 (CE1135-B) (CE1317-A)



MODEL TTD1060 TRANSMITTER

MODEL CHART

MODEL NUMBER	NO. OF FREQS.	CRYSTALS REQUIRED
TTD1060AA	ONE	ONE RN1-A
TTD1060AB	TWO	TWO RN1-A

1. DESCRIPTION

The transmitters listed in the model chart are FM transmitters which operate on crystal-controlled frequencies within the 144-174 mc band. A separate power supply provides the transmitter operating voltages to produce an rf power output of 25 watts.

The single-frequency transmitter consists of a crystal-controlled oscillator, an angular phase modulator, four stages of frequency multiplication and a final amplifier stage. The fundamental crystal frequency is multiplied 24 times to provide the final rf amplifier output frequency.

The two-frequency transmitter is the same as the single frequency model except that a second crystal oscillator, with control crystal, is used. Transmissions are made on two specific crystal-controlled frequencies in the 144-174 mc band. Only one frequency can be transmitted at a time. An external switch is required for changing frequencies and is ordinarily incorporated into the control unit used with the transmitter. This switch causes the desired oscillator to function by grounding its cathode.

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GUARANTEED PERFORMANCE SPECIFICATIONS

BASIC UNIT	TTD1060 (144-174 mc)
RF POWER OUTPUT	25 watts
CRYSTAL MULTIPLICATION	Twenty-four (24) times
POWER SUPPLY	12 v dc operation, positive or negative ground
SPURIOUS AND HARMONIC EMISSION	All spurious and harmonic emissions are attenuated at least 60 db below carrier level.
FREQUENCY STABILITY AND TEMPERATURE RANGE	Oven type crystal unit maintains carrier within ±.0005 percent of assigned center frequency from -30°C. to +60°C. ambient (+25°C. reference).
MODULATION	40F3: ±15 kc for 100 percent at 1000 cps 20F3: ±5 kc for 100 percent at 1000 cps
AUDIO INPUT LEVEL	Factory connection: 0.25 volt ±3 db for 100 percent modulation at 1000 cps (approximately -17 db). Optional connection: 0.18 volt ±3 db for 100 percent modulation at 1000 cps (approximately -20 db).
TUBE COMPLEMENT AND FUNCTION	(1) 6CB6 - RF Oscillator (1-Freq) (1) 6AK6 - 2nd Doubler or (2) 6CB6 - RF Oscillators (2-Freq) (1) 2E26 - Doubler Driver (1) 12AT7 - Modulator, Buffer-Doubler (1) 6146 - Final Amplifier (1) 6CB6 - Tripler (1) 6BH6 - IDC Amplifier (1) 6AL6 - IDC Clipper
NUMBER OF TUNED CIRCUITS	9 following the modulator including 4 tuned multiplier stages, and output circuit
PLATE VOLTAGE REQUIREMENTS	395 v dc at 150 ma 270 v dc at 105 ma 150 v dc at 18 ma -20 v dc bias
DIMENSIONS	15" long x 2-3/8" wide x 5-1/4" high, overall
WEIGHT	4-1/4 lbs.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

FCC License Designation: CC3012

A two-frequency transmitter can be operated on frequencies which are separated by as much as 300 kc from circuit resonance without degradation of the single-frequency performance specifications. All tuned circuits following the oscillators, are normally aligned to the higher, or preferably to the more often used of the two carrier frequencies.

2. CONTROL CRYSTAL REQUIREMENTS

Control crystals, as listed in the MODEL CHART, are required for use with these transmitters and should be ordered separately. See the FOREWORD of the manual for ordering information.

3. CIRCUIT OPERATION

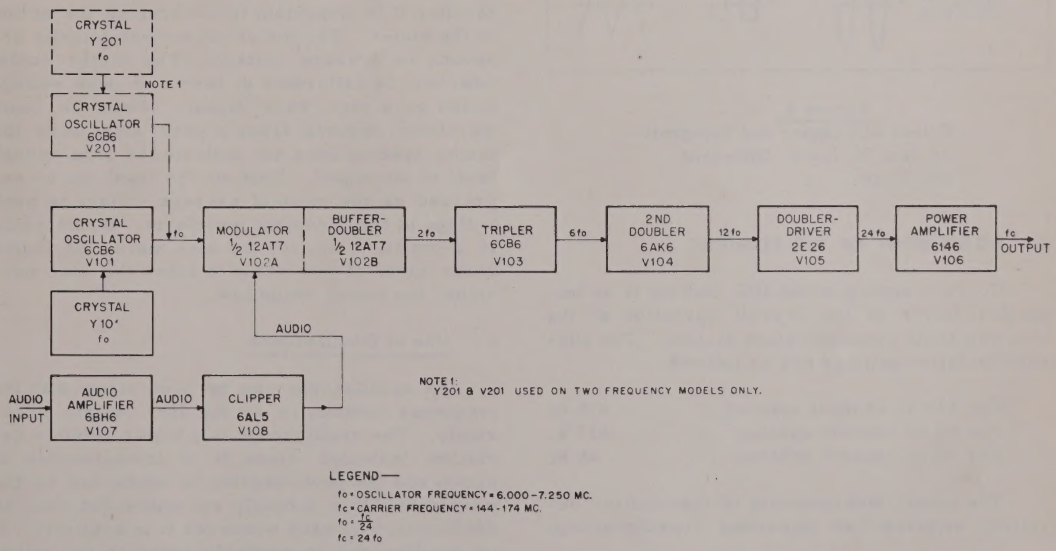
Stage-by-stage signal flow and operating frequencies are shown on the Block Diagram, number 63C856651. Refer to this diagram and Schematic Diagram number 63E856652 to trace the following circuit operation:

a. Audio Input and Amplifier Stage

A MOTOROLA dynamic microphone with built-in transistorized pre-amplifier is usually used with this transmitter. The microphone connects between ground and the shielded lead of the audio amplifier input circuit. A well-filtered dc voltage source of approximately 15 volts connects to R117. This voltage is dropped through resistors R117 and R118 to a value of approximately 4 v dc providing operating power for the transistorized (or carbon) microphone. The microphone cartridge and pre-amplifier act like a variable voltage generator. The output voltage varies with the intensity and frequency of the sound waves which strike the diaphram. Reasonably loud sounds produce an output of 0.25 v ac, which provides full deviation of the rf carrier. If increased sensitivity is desired, a tap can be changed (see schematic diagram, note 6) to provide full deviation of the transmitter with a 0.18 v ac audio signal.

b. Audio-IDC Circuit

Microphone audio output is applied to the clipper tube where the peaks are clipped then the audio is connected to the IDC (instantaneous deviation control) circuit. This circuit limits the slope (steepness) of the audio signals which pass through it, as illustrated in Figure 1. (Note that the clipped waveform is not observable, but is included to show the transition between input and output.) The IDC control sets the amplitude of the signals thereby limiting the maximum



BLOCK DIAGRAM

FINAL METER READINGS

Each time a transmitter is aligned or tested, final meter readings should be made and entered in a logbook.

All readings given in the table below are minimum except PA, which is maximum. DO NOT exceed the value given for the PA current. This is the maximum plate current to which the unit can be safely tuned.

Readings 1 through 6 are purely relative and do not give actual current or voltage measurement.

When using the P-8500 or the P-8501 series test sets, position 7 is a d-c voltmeter with 1000 volts full scale. Actual B+ reading is obtained by multiplying the microampere scale reading by 20. The TU546 series test sets have a 0-1000 volt d-c scale from which the B+ is read directly.

When using the P-8500 or the P-8501 series test sets, position 8 indicates d-c relay control voltage when the transmitter is not keyed. Multiply the microampere scale reading by 0.3 to obtain the actual value of the d-c voltage. When using the TU546 series test sets, the relay control voltage is read directly with the position selector switch in position 10.

For all three series portable test sets, multiply the scale reading by 5 to obtain the actual PA plate current in milliamperes.

SWITCH POSITION		1	2	3	-4	5	6	7	8	PA(+4)
	P-8500 & P-8501 SERIES									
	TU546 SERIES	1	2	3	4	5	6	9	10	7
METER READING		-	-	4	6	11	9	18	-	30

AEPD-1697-A (CE1135-A) (CE1604-B)

PRE-ALIGNMENT NOTES

EXCERPTS FROM F.C.C. REGULATIONS

1. Radio transmitters may be tuned or adjusted only by duly authorized radio operators or by personnel working directly under their supervision.

2. The RF power output of a station shall be no more than required for satisfactory technical operation considering the area to be covered and the local conditions.

TEST EQUIPMENT REQUIRED

1. MOTOROLA Portable Test Set (P-8500 series, P-8501 series or TU546 series)
2. MOTOROLA K-9322 Alignment Tool Kit
3. MOTOROLA T1034A Series Frequency Monitor (for oscillator alignment and deviation adjustment)
4. RF wattmeter or dummy antenna
5. Power Supply (preferably the one designed for the transmitter under test)

HOW TO SET UP THE P-8500 SERIES AND THE P-8501 SERIES TEST SETS

1. Connect the dummy antenna or RF wattmeter to the transmitter ANT. jack.
2. Connect the test set cable plug to the transmitter METER jack.
3. Place the test set REC. - XMTR. -0-50 UA switch in the XMTR. position.
4. Place the GRID CURRENT-METER-FIELD STRENGTH switch in the METER position.
5. Connect the power supply to the transmitter as shown on the intercabling diagram for the equipment.
6. If the power supply chassis has a HI-LO switch place it in the LO position.
7. Turn the equipment on. Allow 30 seconds for the tubes to warm up.

HOW TO SET UP THE TU546 SERIES TEST SET

1. Connect the dummy antenna or RF wattmeter to the transmitter ANT. jack.
2. Connect one end of the metering cable to the test set and the other end to the transmitter METER receptacle.
3. Place the Function Selector Switch in the XMTR. position.
4. Place the oscillator and meter reversing switch in the OFF position.
5. Connect the power supply to the transmitter as shown on the intercabling diagram for the radio set.
6. Place the HI-LO switch on the power supply in the LO position.
7. Turn the equipment on. Allow 30 seconds for the tubes to warm up.

TEST SET SWITCH POSITIONS

P-8500 & P-8501 Series	1	2	3	-4	+4(PA)	5	6	7	8
TU546 Series	1	2	3	4	7	5	6	9	10
Circuit Metered	—	—	Tripler Grid	2nd Doubler Grid	PA Plate Current	Doubler Driver Grid	PA Grid	PA Plate Voltage	Push-to-Talk

HOW TO KEY THE TRANSMITTER

1. Use the XMTR-ON switch of the test set to place the unmodulated carrier on the air for meter reading and adjustment.

2. Use the MOTOROLA TU353A Microphone (or equivalent) to key the transmitter and modulate the carrier as required.

CAUTION

Do not key the transmitter for more than a few seconds at a time until it is properly tuned. Plate current is excessive in untuned stages and may damage the unit. Turn the transmitter on for brief periods while reading the meter and making the adjustments.

FREQUENCY CALCULATIONS

$f_o = \frac{f_c}{24}$ where: f_o = crystal frequency, and f_c = carrier frequency

I.D.C. CONTROL SETTING

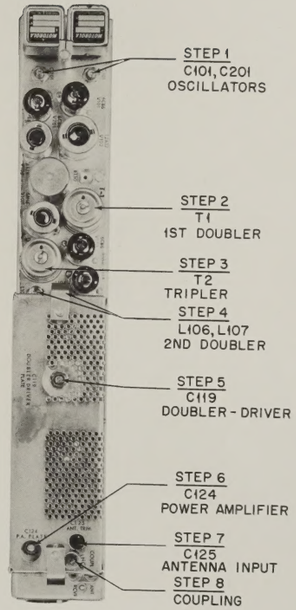
1. Set up the Frequency Monitor for voice modulation measurement. (If an oscilloscope is available see text for I.D.C. setting using the scope.)

2. Turn transmitter on and modulate with 1000 cps tone.

3. Adjust the I.D.C. control (R130) on the transmitter chassis until the MODULATION DEVIATION meter on the station monitor reads as outlined in the following paragraphs.

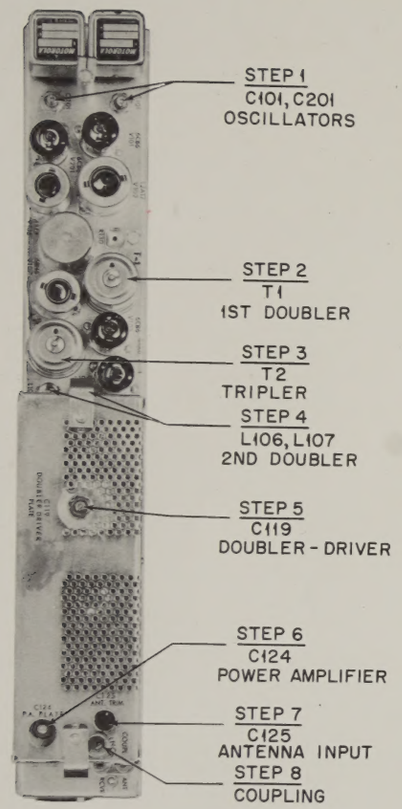
   (a) When the transmitter is intended for operation on a 60 kc or 120 kc channel spacing, the I.D.C. control should be adjusted for an approximate 17 kc reading on the station monitor MODULATION DEVIATION METER. Note that the MODULATION DEVIATION METER reads average voltage but is calibrated in peak voltage. The setting of 17 kc corresponds to a peak of 15 kc.

   (b) When the transmitter is intended for operation on a 30 kc channel spacing, the I.D.C control should be adjusted for an approximate 5-1/2 kc reading on the station monitor MODULATION DEVIATION METER.



ALIGNMENT PROCEDURE

STEP	SWITCH POSITION TU546 TEST SET	ADJUSTMENT	METER READING	STAGE, CONDITIONS AND PROC
1	2	C101 C201	Maximum On-frequency Allow 15 min-utes crystal warm-up period	OSCILLATOR. Adjust only when primary or secondar available (MOTOROLA T1034A may be used). Set Adjust C101 for "on-frequency" reading on monitor. frequency transmitter adjust C201, same as above, ex monitor to accept frequency No. 2. The adjustments should be made with the transmitter switched to the hi preferably to the frequency more commonly used.
2	3	T1	Maximum	1ST DOUBLER. Adjust primary slug from bottom. A top. The circuit frequency is twice the crystal freque
3	4	T2	Maximum	TRIPLER. Adjust primary slug from bottom. Adjust The circuit frequency is six times the crystal frequenc meter switch in position 4.
4	5	L106 L107	Maximum	2ND DOUBLER. Adjust L106 and L107 for maximum frequency is twelve times the crystal frequency. Repe position 5.
5	6	C119	Maximum	DOUBLER-DRIVER. Adjust C119 for maximum. Tun meter will always show the fixed bias in this position. indicates proper alignment. The circuit frequency is crystal frequency.
6	7	C124	Minimum (Dip)	POWER AMPLIFIER. Set C125 for minimum plate cu adjustment fully clockwise (decoupled). Tune C124 for HI-LO switch to HI.
7	7	C125	Maximum	ANTENNA INPUT. Adjust C125 for maximum meter (150 ma).
8	7	COUPLING and C124 or C125	Maximum rf Output NOTE DO NOT EXCEED 150 ma	ANTENNA COUPLING. Remove test load and connect 1. Using field strength meter: Make adjustments with transmitter shielded a Place rf probe near antenna. Adjust C125 an indication on meter. Do not exceed 150 ma. 2. Without field strength meter: Turn COUPLING counterclockwise (increasing C124 for dip. Increase coupling until only a overcouple. This causes the dip to disappear Recheck setting of C125. DO NOT EXCEED L107 and C119. Tighten locknuts on C124.



ALIGNMENT PROCEDURE

STEP	SWITCH POSITION TU546 TEST SET	ADJUSTMENT	METER READING	STAGE, CONDITIONS AND PROCEDURE
1	2	C101 C201	Maximum On-frequency Allow 15 minutes crystal warm-up period	OSCILLATOR. Adjust only when primary or secondary frequency standard is available (MOTOROLA T1034A may be used). Set up frequency monitor. Adjust C101 for "on-frequency" reading on monitor. When aligning a two-frequency transmitter adjust C201, same as above, except set frequency monitor to accept frequency No. 2. The adjustments in Steps 2 through 8 should be made with the transmitter switched to the higher frequency or preferably to the frequency more commonly used.
2	3	T1	Maximum	1ST DOUBLER. Adjust primary slug from bottom. Adjust secondary slug from top. The circuit frequency is twice the crystal frequency.
3	4	T2	Maximum	TRIPLER. Adjust primary slug from bottom. Adjust secondary slug from top. The circuit frequency is six times the crystal frequency. Repeak T1 with the meter switch in position 4.
4	5	L106 L107	Maximum	2ND DOUBLER. Adjust L106 and L107 for maximum meter reading. The circuit frequency is twelve times the crystal frequency. Repeak T2 with the switch in position 5.
5	6	C119	Maximum	DOUBLER-DRIVER. Adjust C119 for maximum. Tune for a definite peak. The meter will always show the fixed bias in this position. A definite peak reading indicates proper alignment. The circuit frequency is twenty-four times the crystal frequency.
6	7	C124	Minimum (Dip)	POWER AMPLIFIER. Set C125 for minimum plate current. Turn COUPLING adjustment fully clockwise (decoupled). Tune C124 for a dip. Set power supply HI-LO switch to HI.
7	7	C125	Maximum	ANTENNA INPUT. Adjust C125 for maximum meter reading. Do not exceed 30 (150 ma).
8	7	COUPLING and C124 or C125	Maximum rf Output NOTE DO NOT EXCEED 150 ma	ANTENNA COUPLING. Remove test load and connect antenna. 1. Using field strength meter: Make adjustments with transmitter shielded as much as possible by housing. Place rf probe near antenna. Adjust C125 and COUPLING for maximum rf indication on meter. Do not exceed 150 ma. 2. Without field strength meter: Turn COUPLING counterclockwise (increasing) gradually while retuning C124 for dip. Increase coupling until only a slight dip is apparent. DO NOT overcouple. This causes the dip to disappear and reduces power output. Recheck setting of C125. DO NOT EXCEED 150 ma. Repeak T1, T2, L106, L107 and C119. Tighten locknuts on C124.

FINAL METER READINGS

Each time a transmitter is aligned or tested, final meter readings should be made and entered in a logbook.

All readings given in the table below are minimum except PA, which is maximum. DO NOT exceed the value given for the PA current. This is the maximum plate current to which the unit can be safely tuned.

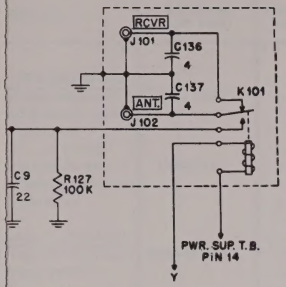
Readings 1 through 6 are purely relative and do not give actual current or voltage measurement.

When using the P-8500 or the P-8501 series test sets, position 7 is a d-c voltmeter with 1000 volts full scale. Actual B+ reading is obtained by multiplying the microampere scale reading by 20. The TU546 series test sets have a 0-1000 volt d-c scale from which the B+ is read directly.

When using the P-8500 or the P-8501 series test sets, position 8 indicates d-c relay control voltage when the transmitter is not keyed. Multiply the microampere scale reading by 0.3 to obtain the actual value of the d-c voltage. When using the TU546 series test sets, the relay control voltage is read directly with the position selector switch in position 10.

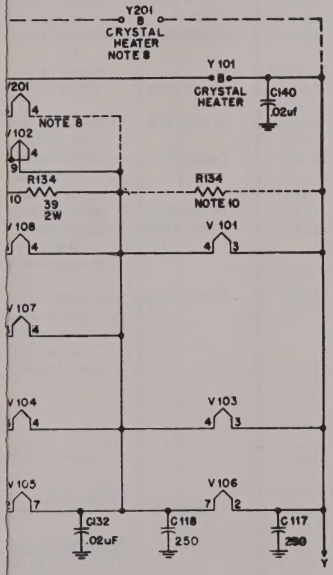
For all three series portable test sets, multiply the scale reading by 5 to obtain the actual PA plate current in milliamperes.

SWITCH POSITION										
	P-8500 & P-8501 SERIES	1	2	3	-4	5	6	7	8	PA(+4)
	TU546 SERIES	1	2	3	4	5	6	9	10	7
METER READING		-	-	4	6	11	9	18	-	30



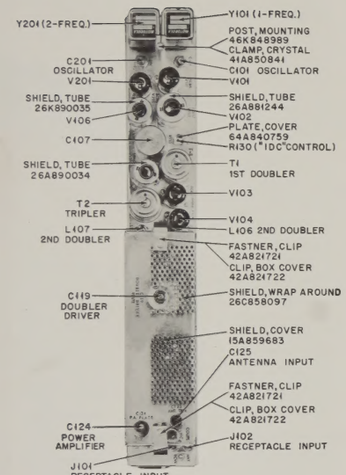
REVISIONS

DIAG. ISSUE	CHASSIS SUFFIX	REF. SYMBOL	CHANGE	LOCATION
A	TTD1060AA-1 TTD1060AB-1	C105	WAS 5 uuf	V102A-2
		C117	WAS 800 uuf	V106-2
		C118	WAS 800 uuf	V106-7
B	TTD1060AA-2 TTD1060AB-2	R119	WAS 27K	V107-1
C	TTD1060AA-3 TTD1060AB-3	C105	WAS 3.3 uuf	V102A-2 (MODULATOR GRID)
D			CHASSIS MARKINGS ADDED TO DIAGRAM	

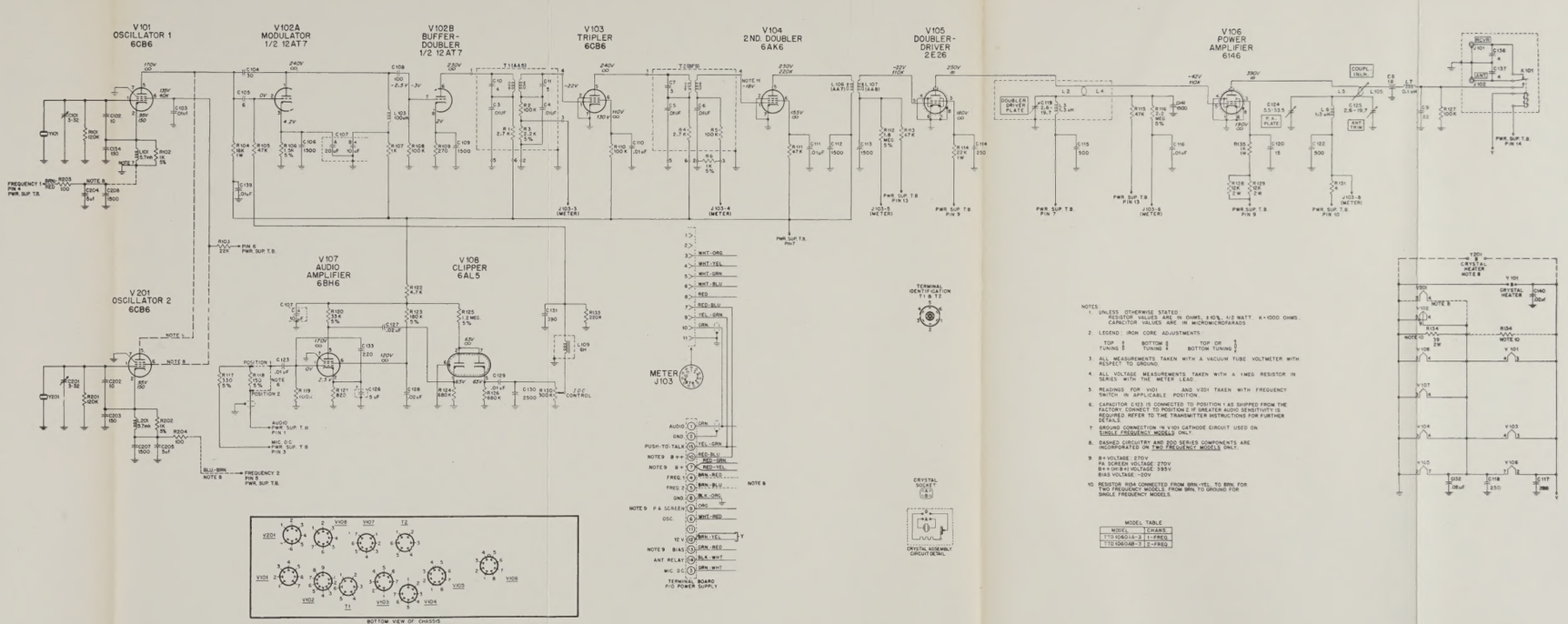


TTD1060 Transmitter
Schematic Diagram
Motorola No. 63E856652-D
11/3/59-RCS

AEPD-1690-A (CE1135-A) (CE1605-C)



AEPD-1690-A



NOTES
1. UNLESS OTHERWISE STATED RESISTOR VALUES ARE IN OHMS, ±10%, 1/2 WATT. K=1000 OHMS. CAPACITOR VALUES ARE IN MICROMICROFARADS.
2. LEGEND: IRON CORE ADJUSTMENTS
   TOP ↑ BOTTOM ↓ TUNING ↕ — TOP OR BOTTOM TUNING ↕
3. ALL MEASUREMENTS TAKEN WITH A VACUUM TUBE VOLTMETER WITH RESPECT TO GROUND.
4. ALL VOLTAGE MEASUREMENTS TAKEN WITH A 1MEG RESISTOR IN SERIES WITH THE METER LEAD.
5. READINGS FOR V101 AND V201 TAKEN WITH FREQUENCY SWITCH IN APPLICABLE POSITION.
6. CAPACITOR C123 IS CONNECTED TO POSITION 1 AS SHIPPED FROM THE FACTORY. CONNECT TO POSITION 2 IF GREATER AUDIO SENSITIVITY IS REQUIRED. REFER TO THE TRANSMITTER INSTRUCTIONS FOR FURTHER DETAILS.
7. GROUND CONNECTION IN V101 CATHODE CIRCUIT USED ON SINGLE FREQUENCY MODELS ONLY.
8. DASHED CIRCUITRY AND 200 SERIES COMPONENTS ARE INCORPORATED ON TWO FREQUENCY MODELS ONLY.
9. B+ VOLTAGE 270V
   B++ (HI B+) VOLTAGE 370V
   B++ (HI B+) VOLTAGE 395V
   BIAS VOLTAGE -20V
10. RESISTOR R134 CONNECTED FROM BRN-YEL TO BRN. FOR TWO FREQUENCY MODELS FROM BRN. TO GROUND FOR SINGLE FREQUENCY MODELS.

MODEL TABLE

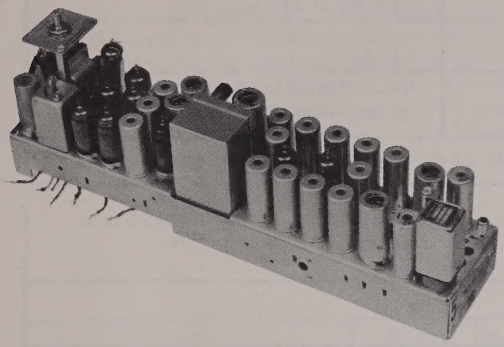
MODEL	CHASS
TTD1060A-3	1-FREQ.
TTD1060AB-3	2-FREQ.

REVISIONS

DIAG. REVIE	CHASSIS SUFFIX	REF. SYMBOL	CHANGE	LOCATION
A	TTD1060AA-1 TTD1060AB-1	C103	WAS 5 mf WAS 500 mmf	V102A-2 V102B-2
		C117		V106-2
		C118	WAS 500 mmf	V106-7
B	TTD1060AA-2	R119	WAS 27K	V107-1
C	TTD1060AA-3 TTD1060AB-3	C105	WAS 3.3 mf	V102A-2 (MODULATOR C105)
D			CHASSIS MARKINGS ADDED TO DIAGRAM	

TTD1060 Transmitter
Schematic Diagram
Motorola No. 63E856652-D
11/3/59-RCS

RECEIVER



TA237W RECEIVER

MODEL CHART

Series	Model No.	No. Of Freq.	Channel Spacing
TRD1170AA/ TA237W	TRD1171AA/ TA237W-L	1	60 kc
	TRD1172AA/ TA237W-H		
TRD1170AC/ TA237W-R2	TRD1171AC/ TA237W-R2-L	2	60 kc
	TRD1172AC/ TA237W-R2-H		
TRD1170AB/ TA237S	TRD1171AB/ TA237S-L	1	30 kc
	TRD1172AB/ TA237S-H		
TRD1170AD/ TA237S-R2	TRD1171AD/ TA237S-R2-L	2	30 kc
	TRD1172AD/ TA237S-R2-H		

1. DESCRIPTION

a. Application

The receivers listed in the model chart are designed to receive FM signals on one (or two) fixed, crystal-controlled frequencies in the 144-174 mc band. The receivers obtain operating voltages from the power supply which is part of the overall radio set.

b. Design

The receiver incorporates a double-conversion superheterodyne circuit. The chassis has 15 tubes and 18 tuned circuits, excluding the plastic-sealed circuits of the "permakay" i-f filter. The i-f wave filter is the major factor in determining the signal reception bandwidth. On models designed for 30 kc channel spacing operation the signals are attenuated -100 db at ±15 kc On 60 kc models the signals are attenuated -100 db at ±32 kc.

c. Basic Receiver Circuitry

The basic receiver circuit consists of the following stages: an rf amplifier, a first local oscillator, a first mixer, a first i-f amplifier, a second local oscillator, a second mixer, three second i-f amplifiers, two limiters, a discriminator and two stages of audio amplification.

d. Two-Frequency Models

Models which carry the -R2 suffix designation are two-frequency versions of the basic single-frequency receiver. The two-frequency receiver is the same as the single-frequency receiver except for the addition of another first oscillator and control crystal. Two-frequency models receive signals on two specific, crystal-controlled frequencies in the band. Only one frequency can be received at a time. The two-frequency receivers are designed for operation with

PARTS LIST for Transmitter Diagram 63E856652-D

REFERENCE SYMBOL	MOTOROLA PART No.	DESCRIPTION
		CAPACITOR, fixed; uuf; 500 vdcw; unless otherwise stated
C1		NOT USED
C2		NOT USED
C3	21B801139	.01 uf +80-20%; 600 vdcw
C4		same as C3
C5		same as C3
C6		same as C3
C7	21K852259	feed-thru; 18 ±5%
C8	21K851767	feed-thru; 18 ±5%
C9	21R124554	22 ±5%
C10	21K840850	4 ±.5 uuf
C11	21K840847	5 ±.5 uuf
C101	19K859115	variable; 3-32
C102	21K859119	10 ±.5 uuf
C103		same as C3
C104	21K848156	30 ±5%
C105	21K840848	6 ±.5 uuf
C106	21B800801	1500 GMV +100% max
C107	23K892117	elec; consists of:
C107A		20 uf +50-10%; 450 vdcw
C107B	△	10 uf +50-10%; 450 vdcw
C107C	□	10 uf +100-10%; 25 vdcw
C108	21K840046	100 ±10%
C109		same as C106
C110		same as C3
C111		same as C3
C112		same as C106
C113		same as C106
C114	21A112247	250 ±10%; 850 vdcw
C115	21A824948	500 +20-10%; 600 vdcw
C116		same as C3
C117		same as C114
C118		same as C114
C119	19K800032	variable; 2.6-19.7
C120	21K835358	15 ±10%
C121		NOT USED
C122		same as C115
C123		same as C3
C124	19B858032	variable; 5.5-33.5
C125		same as C119
C126	23K890624	elec; 5 uf +100-15%; 150 vdcw
C127	21B401029	.02 uf +80-20%; 600 vdcw
C128		same as C127
C129		same as C3
C130	21K859773	2500 ±5%
C131	21K848158	390 ±10%; 300 vdcw
C132		same as C127
C133	21R410115	220 ±20%
C134	21K840047	150 ±5%
C135		NOT USED
C136	21K840850	4 ±.5 uuf
C137		same as C136
C138		NOT USED
C139		same as C3
C140		same as C127
C141		same as C106
C201		same as C101
C202		same as C102
C203		same as C134
C204	23K857384	elec; 5 uf +100-10%; 150 vdcw
C205		same as C204
C206		NOT USED
C207		same as C106
C208		same as C106

REFERENCE SYMBOL	MOTOROLA PART No.	DESCRIPTION
		CONNECTOR, receptacle: female;
J101	9A87120	single contact; round molded mica filled base; chassis mounted
J102		same as J101
J103	9B880881	11 contact; polarized; round molded black phenolic base; saddle mounted
		RELAY, armature:
K101	59K854405	12 v dc; non-coaxial; contact arrangement, 1 form "C"
		NOTE Relay K101 is mounted inside 1V840693 ASSEMBLY, shield (includes J101, J102); shield assembly must be ordered separately
		COIL, RF:
L1		NOT USED
L2	1V835418	Doubler Driver Plate; includes C119
L3	24A891063	choke: 1.3 uh; coded BLU dot
L4	1V859750	Power Amplifier Grid
L5	24A858031	Power Amplifier Plate; includes L6
L6		same as L3
L7	24A852574	Filter; .1 uh
L101	24K847941	choke; 5.7 mh; coded BRN-YEL
L102		NOT USED
L103	24A832402	choke; 100 uh; coded BLU dot; Modulator
L104		same as L3
L105	24A858093	Antenna Pick-up Loop
L106	24B835395	2nd Doubler Plate; base stamped AA7; includes 1V835422 CORE, adjustable tuning; and clip; coded BLUE dot
L107	24K835396	2nd Doubler Grid; base stamped AA8; includes 1V835422 CORE, adjustable tuning; and clip; coded BLUE dot
L108		NOT USED
L201		same as L101
		COIL, AF:
L109	25D850636	choke; 6 henries
		RESISTOR, fixed: composition; ±10%; 1/2 w; ins. unless otherwise stated
R1	6R5577	2.7K
R2	6R6031	100K
R3	6R2028	2.2K ±5%;
R4		same as R1
R5		same as R2
R6	6R6411	1K ±5%
R101	6R5631	120K
R102	6R6411	1K ±5%
R103	6R6397	22K
R104	6R5734	18K; 1 w
R105	6R6048	47K
R106		same as R102
R107	6R6229	1K
R108		same as R2
R109	6R6432	270 ohm

REFERENCE SYMBOL	MOTOROLA PART No.	DESCRIPTION
		RESISTOR, (cont'd)
R110		same as R2
R111		same as R105
R112	6R401017	1.8 meg ±5%
R113	6R6434	27K
R114	6R6341	22K; 1 w
R115		same as R105
R116	6R2073	2.2 meg ±5%
R117	6R120638	330 ohm ±5%
R118	6R5645	150 ohm ±5%
R119		same as R2
R120	6R2068	33K ±5%
R121	6R6269	820 ohm
R122	6R6080	4.7K
R123	6R2061	180K ±5%
R124	6R6475	680K
R125	6R5779	1.2 meg
R126		same as R124
R127		same as R2
R128	6R5766	12K; 2 w
R129		same as R128
R130	18K812998	variable; 300K ±20%; 1/4 w
R131	17K892469 or 17B821901	wire wound; 4 ohm ±2%; 1 w wire wound; 4 ohm ±2%; 3 w
R132		NOT USED
R133		same as R119
R134	6R488043	39 ohm; 2 w
R135	6R6327	1K; 1 w
R201		same as R101
R202		same as R102
R203	6R6326	100 ohm
R204		same as R203
		TRANSFORMER, RF:
T1	24B835397	1st Doubler; base stamped AA5; includes: 1V87207 CORE, adjustable tuning; and palnut 1V87208 CORE, adjustable tuning; and clip Reference parts C3, C4, C10, C11, R1, R2, R3
T2	24K861145	Tripler; base stamped BF9; includes: 1V87207 CORE, adjustable tuning; and palnut 1V87208 CORE, adjustable tuning; and clip Reference parts C5, C6, C7, R4, R5, R6
		TUBE,
V101	6CB6	electron
V102	12AT7	electron
V103		same as V101
V104	6AK6	electron
V105	2E26	electron
V106	6146	electron
V107	6BH6	electron
V108	6AL6	electron
V201		same as V101
		SOCKET, tube: female;
XV101	9K87124	7 contact; miniature; molded mica filled phenolic base; includes center shield; saddle mounting
XV102	9B881243	9 contact; miniature; molded mica filled phenolic base; includes center shield and tube shield base; saddle mounting
XV103		same as XV101

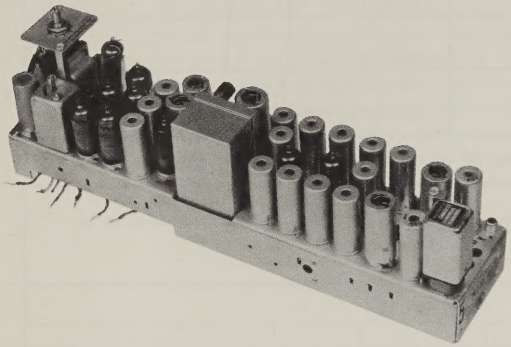
REFERENCE SYMBOL	MOTOROLA PART No.	DESCRIPTION
		SOCKET, (cont'd)
XV104		same as XV101
XV105	9B890001	8 contact; brown bakelite wafer base; saddle mounting
XV106		same as XV105
XV107	9B834083	7 contact; miniature; molded mica filled phenolic base; includes center shield and tube shield base; saddle mounting
XV108		same as XV107
XV201		same as XV101
		SOCKET, crystal: female;
XY101	9K857508	4 contact; square molded black bakelite base; chassis mounted
XY201		same as XY101

CRYSTAL

NOTE
When ordering a Transmitter Chassis only, crystals must be ordered separately. Crystal type number and operating frequency must be specified when ordering crystal.

REFERENCE SYMBOL	MOTOROLA PART No.	DESCRIPTION
Y101	Type RN1-A	CRYSTAL UNIT, quartz: assembly; includes 12 volt heater element and thermostat

CE022



TA237W RECEIVER

MODEL CHART

Series	Model No.	No. Of Freq.	Channel Spacing
TRD1170AA/ TA237W	TRD1171AA/ TA237W-L	1	60 kc
	TRD1172AA/ TA237W-H		
TRD1170AC/ TA237W-R2	TRD1171AC/ TA237W-R2-L	2	60 kc
	TRD1172AC/ TA237W-R2-H		
TRD1170AB/ TA237S	TRD1171AB/ TA237S-L	1	30 kc
	TRD1172AB/ TA237S-H		
TRD1170AD/ TA237S-R2	TRD1171AD/ TA237S-R2-L	2	30 kc
	TRD1172AD/ TA237S-R2-H		

1. DESCRIPTION

a. Application

The receivers listed in the model chart are designed to receive FM signals on one (or two) fixed, crystal-controlled frequencies in the 144-174 mc band. The receivers obtain operating voltages from the power supply which is part of the overall radio set.

b. Design

The receiver incorporates a double-conversion superheterodyne circuit. The chassis has 15 tubes and 18 tuned circuits, excluding the plastic-sealed circuits of the "permakay" i-f filter. The i-f wave filter is the major factor in determining the signal reception bandwidth. On models designed for 30 kc channel spacing operation the signals are attenuated -100 db at ±15 kc On 60 kc models the signals are attenuated -100 db at ±32 kc.

c. Basic Receiver Circuitry

The basic receiver circuit consists of the following stages: an rf amplifier, a first local oscillator, a first mixer, a first i-f amplifier, a second local oscillator, a second mixer, three second i-f amplifiers, two limiters, a discriminator and two stages of audio amplification.

d. Two-Frequency Models

Models which carry the -R2 suffix designation are two-frequency versions of the basic single-frequency receiver. The two-frequency receiver is the same as the single-frequency receiver except for the addition of another first oscillator and control crystal. Two-frequency models receive signals on two specific, crystal-controlled frequencies in the band. Only one frequency can be received at a time. The two-frequency receivers are designed for operation with

GUARANTEED PERFORMANCE SPECIFICATIONS

MODEL NUMBER	TRD1171AB/TA237S-L TRD1172AB/TA237S-H	TRD1171AA/TA237W-L TRD1172AA/TA237W-H
	TRD1171AD/TA237S-R2-L TRD1172AD/TA237S-R2-H	TRD1171AC/TA237W-R2-L TRD1172AC/TA237W-R2-H
CHANNEL SPACING	30 kc	60 kc
SELECTIVITY	-100 db at ±15 kc	-100 db at ±32 kc
MODULATION ACCEPTANCE	±5 kc	±15 kc
TUNED CIRCUITS	30 including 12 plastic-sealed in "permakay" filter	30 including 12 plastic-sealed in "permakay" filter
SENSITIVITY	Less than 0.50 microvolt for 20 db quieting; 50 ohms rf input impedance	
FREQUENCY STABILITY AND TEMPERATURE RANGE	Oven type crystal maintains oscillator stability within ±0.0005% from -30°C. to +60°C. ambient (+25C. reference)	
SPURIOUS AND IMAGE REJECTION	More than 100 db	
SQUELCH	Noise compensated type, adjustable sensitivity, threshold sensitivity of 0.18 microvolt	
TUBE COMPLEMENT AND FUNCTION	6AK5 - RF amp. *6BC5 - oscillator 6AB4 - 1st mixer 6BH6 - 1st i-f amp. 12AT7 - 2nd osc. - mixer 6CB6 - 2nd i-f amp. (1) 6CB6 - 2nd i-f amp. (2) 6CB6 - 2nd i-f amp. (3) *two for 2-frequency models	6BH6 - 1st limiter 6BJ6 - 2nd limiter 6AL5 - discriminator 6BH6 - noise amp. 6C4 - noise rectifier 6679/12AT7 - audio and squelch amp. 6AQ5 - audio output
AUDIO OUTPUT	2 watts to a 3 ohm speaker at less than 10% distortion	
AUDIO RESPONSE	From +1 db to -8 db of 6 db/octave de-emphasis characteristic from 300-3000 cps	

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

a frequency separation between channels as great as 240 kc without any change in performance specifications. An external switch is used to select frequencies. The switch is connected into the cathode circuits of the two first local oscillator stages. In the F1 position the switch grounds the cathode of the #1 oscillator, permitting that stage to operate normally. At the same time it opens the cathode of the #2 oscillator to disable the #2 stage. In the F2 position the switch reverses the connections and selects the #2 local oscillator. The F1-F2 switch is part of the control head in mobile radio sets.

e. Chassis Complement

Each receiver consists of a basic chassis and a number of other items depending upon the frequency range, number of operating frequencies and channel spacing operation. The receivers are factory assembled from the sub-assemblies to form a compact single unit. The items included in each receiver are summarized in the following chart.

MODEL NUMBER	FREQ.		BASIC CHASSIS				*COIL KIT				FILTER			CRYSTAL	
X=1 USED 2=2 USED	1-FREQ.	2-FREQ.	TU552	TU552-R2	TU552S	TU552S-R2	TK187AL	TK187AH	TK187AL-R2	TK187AH-R2	TU540W	TU540S	TU540X	G03 (I-F)	RM10-A (CONTROL)
TRD1171AA/TA237W-L TRD1172AA/TA237W-H	X		X				X				X			1	1
								X							
TRD1171AC/TA237W-R2-L TRD1172AC/TA237W-R2-H		X		X					X		X			1	2
										X					
TRD1171AB/TA237S-L TRD1172AB/TA237S-H	X				X		X					X		1	1
								X							
TRD1171AD/TA237S-R2-L TRD1172AD/TA237S-R2-H		X				X			X			X		1	2
										X					

* Coil kit designations include an H or L to indicate frequency range:

H = 152-174 mc L = 144-152 mc

2. OPERATION

a. Stage Analysis

This receiver operates in accordance with basic FM receiver operation theory. The stage analysis given in these instructions is but a brief summary of the salient points. To follow the discussion refer to the block diagram. This diagram shows stage-by-stage signal flow and operating frequencies.

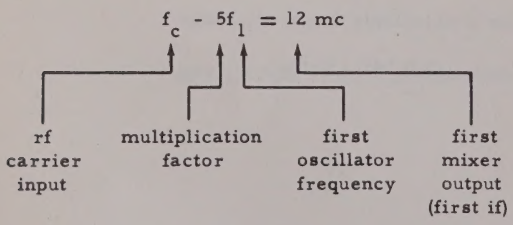
b. RF Amplifier

The carrier signals received at the antenna are coupled to the grid of the RF amplifier by the impedance-matching network in the input circuit. The rf stage provides some amplification of the signals, however, its main purpose in the circuit is to improve sensitivity and selectivity. The gain of this stage is designed to provide the optimum signal-to-noise ratio in the signals sent to the first mixer. In the output of this stage three hi-Q, critically coupled tuned circuits provide very high selectivity in the signals which pass on to the mixer.

c. First Oscillator and Mixer

The first oscillator generates a signal which is multiplied five times and heterodyned with the incoming rf carrier in the first mixer stage. The difference between these two frequencies is used as the mixer output. This output is a 12 mc signal which carries the modulation originally impressed on the incoming rf carrier.

These frequency relationships can be expressed as follows:



$$f_1 = \frac{f_c - 12 \text{ mc}}{5}$$; where f_c is the carrier freq.

The multiplied oscillator frequency and the rf carrier are used as the input to the first mixer. The output from the first mixer is called the first intermediate frequency (first i-f).

d. First I-F and Second Mixer

The signals are amplified in the first i-f amplifier and applied to the second mixer along with an injection frequency generated in the second local oscillator. The second local oscillator frequency is controlled by the i-f crystal. This frequency is 12455 kc, the same for all receivers regardless of rf carrier frequency. The difference between the second local oscillator frequency and the first i-f is the second mixer output. This output is a 455 kc signal which carries the audio modulation. The frequency relationships of these three stages are as follows:

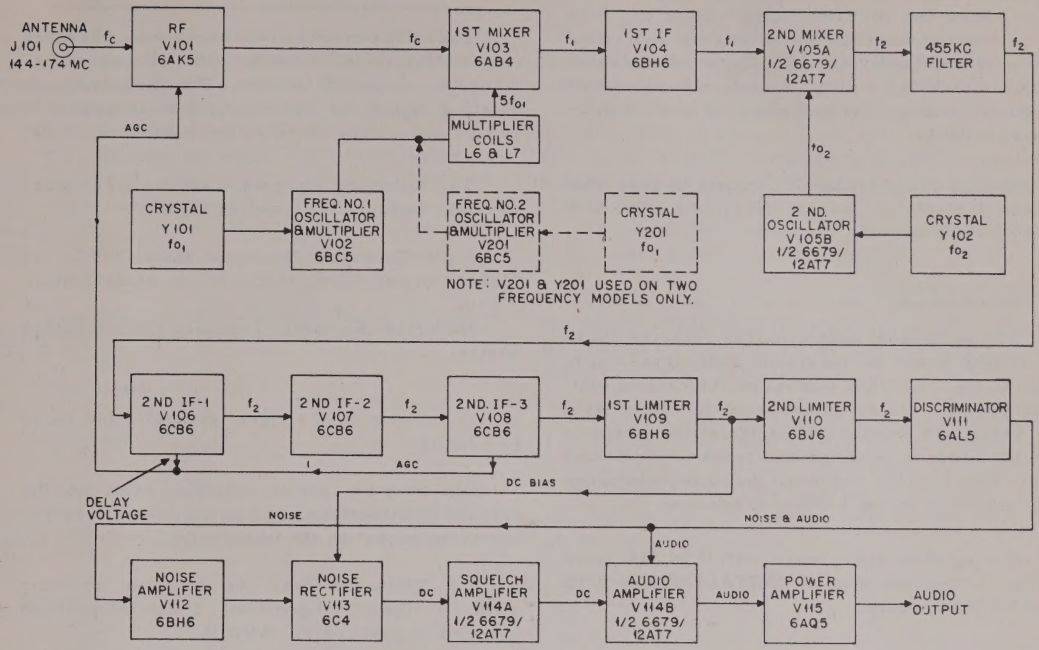
Second local oscillator freq.	12455 kc
First intermediate freq.	12000 kc
Difference freq. (second i-f)	455 kc

e. Second I-F

A "permakay" i-f filter is used in the second i-f before the amplification stages. This filter is permanently sealed in polyesterstyrene is unconditionally guaranteed for the life of the receiver provided the seal is unbroken and the housing is not tampered with. This filter is the major factor in determining the bandwidth of the receiver. It greatly attenuates the signal outside the pre-determined pass-band. Signals leaving the filter are amplified by three stages of second i-f amplification (tubes V106, V107 and V108) and applied to the limiter stages.

f. Limiters Discriminator and Audio Stages

The two limiter stages, tubes V109 and V110, clip the tops and bottoms of the incoming signals, thereby virtually eliminating the noise which characteristically "rides" the signals in the form of amplitude modulation. These stages are largely responsible for the "quieting" effect inherent in the FM communications receiver when it picks up an on-frequency signal. The limiter output is sent to the discriminator, tube V111, which translates frequency deviations into corresponding amplitude variations, thereby detecting the audio modulation. The audio amplification stage provides two watts audio output to a three ohm load.



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LEGEND:

f_c = CARRIER FREQUENCY = 144 - 174 MC.

f_{o1} = 1ST. OSCILLATOR FREQUENCY = $\frac{f_c - f_1}{5}$ = 26.4 - 32.4 MC.

f_1 = 1ST. INTERMEDIATE FREQUENCY = $f_c - 5\,f_{o1}$ = 12 MC.

f_2 = 2ND. INTERMEDIATE FREQUENCY = $f_{o2} - f_1$ = 455 KC.

f_{o2} = 2ND. OSCILLATOR FREQUENCY = 12.455 MC.

g. Noise-Actuated Squelch Circuit

The noise-actuated squelch circuit consists of a noise amplifier, a noise rectifier, a dc amplifier and associated circuit components, as shown on the schematic diagram. The discriminator output is applied to the input of the noise amplifier, V112. The input r-c network greatly attenuates the low-frequency components but passes frequencies above 3000 cps. These random frequencies are applied as a signal to the grid of V112 and amplified like other types of signal inputs. In the cathode of the noise amplifier the variable SQUELCH control varies the gain of the tube by adjusting its bias. The setting of this control is covered in the following paragraph.

The output of the noise amplifier drives the noise rectifier, V113. The rectified noise signal appears as positive voltage across the load resistor, R152. This positive voltage is added to a steady negative bias taken from the second limiter stage. The resultant of these two voltages is applied to the grid of the dc amplifier tube. In the no-signal condition, i.e., noise alone, the resultant voltage is zero or somewhat positive. The dc amplifier conducts and cuts off the audio amplifier tube. This keeps the speaker silent when signals are not being received. When signals are received the noise is greatly reduced and the rectified noise output is not enough to overcome the steady negative bias on the grid of the dc amplifier. In this condition, the dc amplifier is cut off and the audio amplifier operates, passing on the received audio signals.

h. Squelch Control

The SQUELCH control limits the gain of the noise amplifier tube. In practice, this control is

adjusted for a "threshold" setting. This is the point where the rectified noise voltage will bias the grid of the dc amplifier so that the audio amplifier is just barely cut-off. Then, when a weak signal is received a slight reduction in noise will cut off the dc amplifier and allow the audio amplifier to conduct.

Setting of the SQUELCH control is described in the instruction manual INSTALLATION AND OPERATION section.

i. Audio Level

The audio level control on the receiver chassis is used to set the maximum audio level available at the VOLUME control on the control unit. This permits future adjustments to compensate for variations in tube characteristics, resistor and capacitor tolerances and transmitter deviation. This control has more than adequate range of audio drive to the 3 ohm PM speaker.

Setting of the audio level control is described in the instruction manual INSTALLATION AND OPERATION section.

3. ALIGNMENT PROCEDURE

A complete receiver alignment procedure, in chart form, is included in this section. Test set-up information, using a MOTOROLA portable test set, is also included with the alignment procedure.

Any 0-50 microampere meter with an equivalent series resistance of 20,000 ohms may be used as a metering device. The meter should be connected from chassis ground to the pin receptacle of the metering socket corresponding to the stage being measured. Refer to the applicable schematic diagram for specific metering pin receptacle information.

4. PRE-OPERATIONAL NOTES

The receiver is aligned to its exact operating frequency before it is shipped from the factory. It should, however, be checked for proper operation before it is placed in service. Make the frequency check described in step 9 of the alignment chart in this section. Also take meter readings for the first five entries in the stage measurement chart. If the readings are beyond the allowable limits, realign the receiver according to the alignment chart.

a. Sensitivity Adjustment (20 db Quieting)

The receiver sensitivity check should be made in a well shielded location in the absence of extraneous electrical noise. The sensitivity, or quieting signal, is that input signal necessary to reduce the output noise at the speaker by 20 db.

The following equipment is required to accurately measure the quieting signal:

Signal Generator (Motorola Model TU576, or Measurements Corp. Model 80, or equivalent)

Motorola Portable Test Set (Model TU546 Series)

(1) Warm up the signal generator for 1-1/2 to 2 hours.

(2) Plug the test set metering cable into the test set and the other end into the 11-pin receiver metering socket on the radio set.

(3) Place the test set function selector switch in the RCVR position. Place the position selector in position 11, AUDIO.

(4) Set the signal generator to the carrier frequency and connect the signal generator, using the coaxial cable and 6 db pad, to the antenna connector on the radio set. The exact carrier frequency will be indicated by a "0" reading on the "0" center scale of the test set with the position selector switch in position 4. Return the switch to position 11, AUDIO.

(5) Turn the SQUELCH control on the control head fully counterclockwise (open).

(6) Set the VOLUME control to provide any convenient reading on the 0-2 v ac scale on the test set, preferably mid-scale for ease in reading.

(7) If the radio set has a speaker connected to it and in operation, place the test set SPKR switch to the OPEN position. If the radio set under test does not have a speaker connected to it, place the test set SPKR switch to the LOAD position. It is important that only one speaker be in the circuit, i.e., either the speaker on the radio set or the speaker on the test set. Now note the exact meter reading and mark it down for use as a reference later.

(8) Place the test set multiplier switch to the 0.2 v ac position and hold it there. This makes the meter exactly 10 times, or 20 db, more sensitive than the normal 2 v ac position.

(9) Increase the signal until the meter needle is in exactly the same position as noted in step (7). The noise has been reduced 20 db. The receiver sensitivity in microvolts can now be read on the signal generator.

Alternate Method -- 20 db Quieting Measurement

Equipment required:

Ac vtvm

Signal Generator (Motorola Model TU576, or Measurements Corp. Model 80, or equivalent)

(1) Connect the vtvm across the voice coil terminals (terminal #1 and #2 on the power supply receiver terminal board).

(2) With noise only, turn the VOLUME control to a normal listening level and turn the SQUELCH control fully counterclockwise (open).

(3) Note the reading on the meter. This is a reference level to be used later.

(4) Set the signal generator to the carrier frequency and connect the signal generator, using the coaxial cable and 6 db pad, to the antenna connector on the radio set.

(5) Inject a signal until the noise is reduced 1/10 the value as noted in step (3). For example, if step (3) was 1.0 volt, then step (5) should be 0.1 volt. The noise has been reduced 20 db. The receiver sensitivity in microvolts can now be read on the signal generator.

c. Average Stage Measurements

APPROX. MICROVOLT INPUT	INPUT TO	FREQ. IN MC.	METER POSITION	METER READING OR DB.
150,000	Pin 1 of V107 2nd IF-2	.455	1	-5
2000	Pin 1 of V106 2nd IF-1	.455	1	-5
5000	Filter	.455	1	-5
5.0	Pin 1 of V104 1st IF	12.0	*DB Meter	20 db. (quieting)
150			1	-5
3.8	Pin 6 of V103 1st Mixer	12.0	*DB Meter	20 db. (quieting)
30.0			1	-5
2.5	Pin 1 of V101 1st RF	F_c	*DB Meter	20 db. (quieting)
14.0			1	-5
6.0	Antenna	F_c	1	-5
0.5 or less	Antenna	F_c	*DB Meter	20 db. (quieting)
Noise	Antenna	No Signal	1	-0.1 to -1
Noise	Antenna	No Signal	2	-18 to -40
Noise	Antenna	No Signal	4	**0
Noise	Antenna	No Signal	5	-12 to -16
Noise	Antenna	No Signal	6	-12 to -40

NOTE

A Model T1034A Signal Generator was used when taking readings on V101, V103, and V104. A Model 65B Signal Generator with a 30 ohm terminated output cable was used when taking all other readings.

* Refer to paragraph 4 when making this measurement.

** A meter reading of up to ±1 ua of zero is allowable without any degradation.

	ALIGNMENT FREQUENCY	ADJUSTMENT	TU546 TEST SET SWITCH POSITION	METER READING
oil (see DETAIL A, lower left). 1 and set the ON-OFF switch to he probe in its position and place	455 kc, sharp tuning	T1 bottom slug	5	Maximum
meter reading (selector switch	455 kc, sharp tuning	T1 top slug	4	Zero
o that an increase of signal n to keep the input at a constant	455 kc, sharp tuning	L16	2	Maximum
5 ua with the selector switch in	455 kc, broad tuning	L15	1	Maximum
ce the test set ON-OFF switch	455 kc, sharp tuning	L14	1	Maximum
the illustration. After adjusting (pin 1) of V104. The signal tion 1 or 2). Adjust L13 for a ge. The peak found when the and L11 for a maximum meter	12 mc, sharp tuning	L13, L12 and L11	1 or 2	Maximum
1 (pin 6) of V103 and adjust L10,	12 mc, sharp tuning	L10, L9 and L8	1 or 2	Maximum
the screwdriver adjustment slot or switch in position 6. If ile adjusting trimmer C204 and	Receiver crystal frequency, sharp tuning	L5 (L201)	6	Maximum
ntended to receive. A zero . Check the final setting by s the trimmer is rotated. Set	Carrier frequency, sharp tuning	C110, C204	4	Zero
ved. To do this follow the pro- to pin 6 of V103 instead of pin 7, (position 1 or 2).	Carrier frequency, sharp tuning	L7 L6	1 or 2	Maximum
ignal loosely to the grid (pin 1)	Carrier freq., sharp tuning	L4, L3 and L2	1 or 2	Maximum
se a 6 db, 50 ohm, attenuation	Carrier freq., sharp tuning	L1	1 or 2	Maximum
n while making the adjustments. smitter, signal generator or db). Turn VOLUME control on r. Set the selector switch to reduce the meter reading more	Carrier freq., slight adj.	L14	2	Reduce audible noise

AEPD-1707-A (CE057)

AEPD-1406

AEPD-1707-A (CE057)

HOW TO SET UP THE P-8500 AND P-8501 SERIES TEST SETS FOR DISCRIMINATOR AND 455 KC ALIGNMENT

1. Set the REC.-XMTR. 0-50 UA switch to the REC position.
2. Plug a 455 kc crystal into the two-pin crystal socket.
3. Set the GRID CURRENT-METER-FIELD STRENGTH selector switch to the GRID CURRENT position.
4. Set the ATTENUATOR control for maximum output (10).
5. Place the test set ON-OFF switch in the ON position. (Test set operates on internal battery. Conserve battery life by keeping switch OFF when set is not in use.)
6. Adjust the frequency control (ADJ) for a maximum meter reading.
7. Set the ON-OFF switch to the OFF position.
8. Set the GRID CURRENT-METER-FIELD STRENGTH switch to the METER position.
9. Plug the test set metering cable into the METER receptacle on the receiver chassis.
10. Connect one end of the test set extension cable to the RF OUTPUT jack on the test set. Connect the other end of the extension cable to the RF probe cable.

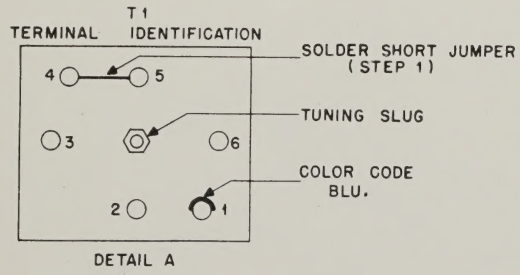
AEPD-1406

HOW TO SET UP THE TU546 SERIES TEST SETS FOR DISCRIMINATOR AND 455 KC ALIGNMENT

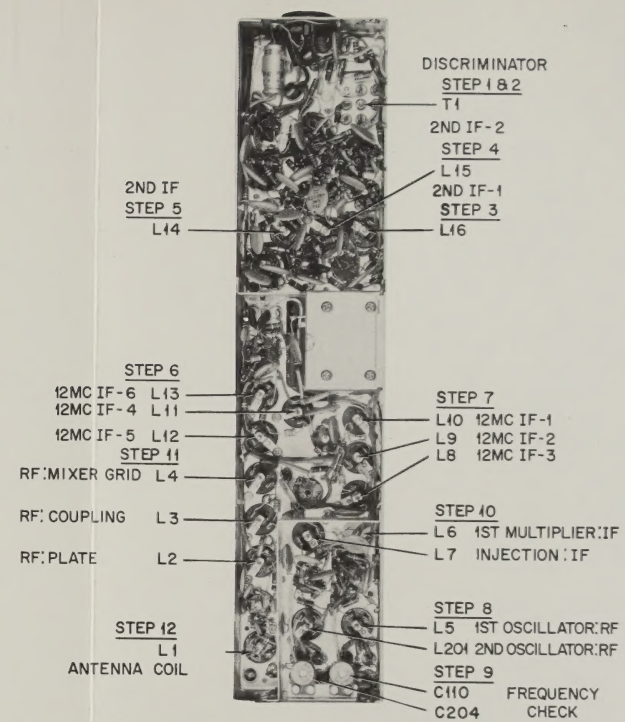
1. Set the function selector switch to the RCVR position.
2. Connect the 20-pin metering cable into the receptacle on the test set. Plug the other end (11-pin) into the metering socket on the receiver.
3. Connect one end of the test set rf extension cable to the rf connector on the test set. Connect the other end of the extension cable to the rf probe cable.
4. Place the oscillator and meter reversing switch to the 455 kc position.

TEST SET SELECTOR SWITCH POSITIONS

P-8500 & P-8501 SERIES TEST SETS	1	2	+4, -4	5	6
TU546 SERIES TEST SETS	1	2	4	5	6
CIRCUIT METERED	2nd I-F #3 Grid	1st Lim. Grid	Discr. Output	Discr. Input	1st Osc. Grid



DETAIL A

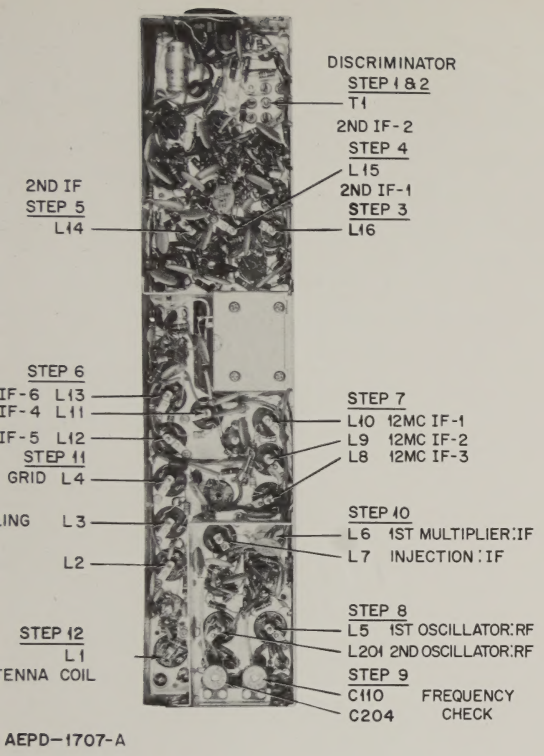


AEPD-1707-A

HOW TO SET UP THE SIGNAL GENERATOR* FOR 12 MC. I.F. ALIGNMENT

1. Couple the signal generator output loosely to the grid (pin 7) of V105. Couple just enough input to give a small meter reading.
2. Set the test set selector switch to position 4. Turn on the test set.
3. Set the signal generator frequency for approximately 12 mc.
4. Locate the exact 12 mc point by rotating the generator dial back and forth around the 12 mc setting until you obtain a meter reading of exactly zero (position 4). The meter reading should go above and below zero as the dial is rotated. Leave the generator set for zero meter reading. Make sure the signal remains constant throughout the alignment (generator may drift).

*Use a Motorola T1034A Series, or equivalent.



AEPD-1707-A

HOW TO SET UP THE SIGNAL GENERATOR*
FOR 12 MC. I.F. ALIGNMENT

the signal generator output loosely to the grid (pin 7) of V105.
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the exact 12 mc point by rotating the generator dial back and
ound the 12 mc setting until you obtain a meter reading of
zero (position 4). The meter reading should go above and be-
o as the dial is rotated. Leave the generator set for zero meter
. Make sure the signal remains constant throughout the align-
enerator may drift).

Motorola T1034A Series, or equivalent.

STEP	STAGE, TEST CONDITIONS AND PROCEDURE	ALIGNMENT FREQUENCY	ADJUSTMENT	TU546 TEST SET SWITCH POSITION	METER READING
1	DISCRIMINATOR PRIMARY -- Solder a short jumper across terminals 4 and 5 of the discriminator secondary coil (see DETAIL A, lower left). Set up the Motorola Test Set as described in the left hand column. Place the test set selector switch in position 1 and set the ON-OFF switch to the ON position. Move the rf probe around near pin 1, V106, until the meter reading is at least 15 ua. Secure the probe in its position and place the selector switch in position 5. Adjust T1 for maximum meter reading. Unsolder the jumper.	455 kc, sharp tuning	T1 bottom slug	5	Maximum
2	DISCRIMINATOR SECONDARY -- With the rf probe placed as in step 1 adjust the top slug of T1 for exactly zero meter reading (selector switch in position 4).	455 kc, sharp tuning	T1 top slug	4	Zero
3	455 KC, I.F. COIL L16 -- Place the rf probe near the input to the 455 kc I-F filter. Couple the signal loosely so that an increase of signal strength will produce a linear increase in meter reading (switch in position 1 or 2). Secure the probe in position to keep the input at a constant level. Adjust L16 for a maximum meter reading with the switch in position 2.	455 kc, sharp tuning	L16	2	Maximum
4	455 KC, I-F COIL L15 -- Couple the signal to the I-F filter so as to obtain a maximum reading of approximately 5 ua with the selector switch in position 1. Adjust L15 for a maximum reading.	455 kc, broad tuning	L15	1	Maximum
5	455 KC, I-F COIL L14 -- Use the same conditions as in step 4. Adjust L14 for a maximum meter reading. Place the test set ON-OFF switch in the OFF position and remove the rf probe.	455 kc, sharp tuning	L14	1	Maximum
6	12 MC. I-F COILS L13, L12 and L11 -- Set up the Motorola T1034A Series (or equivalent) as described below the illustration. After adjusting the signal generator set the test set selector switch to position 1 or 2 and couple the generator output to the grid (pin 1) of V104. The signal must be coupled loosely so that an increase of signal strength produces a linear increase in meter reading (position 1 or 2). Adjust L13 for a maximum meter reading with switch in position 1 or 2, note that two peaks are present within the coil tuning range. The peak found when the slug is nearest the top of the coil (as viewed from bottom of chassis) is the proper alignment peak. Adjust L12 and L11 for a maximum meter reading (position 1 or 2).	12 mc, sharp tuning	L13, L12 and L11	1 or 2	Maximum
7	12 MC. I-F COILS L10, L9 and L8 --Follow the same procedure as in step 6 except couple the signal to the grid (pin 6) of V103 and adjust L10, L9 and L8; no double peaks will be found.	12 mc, sharp tuning	L10, L9 and L8	1 or 2	Maximum
8	FIRST OSCILLATOR COIL L5 -- Uncouple the signal generator. Position the ceramic trimmer, C110, so that the screwdriver adjustment slot is parallel with the length of the receiver chassis. Adjust coil L5 for a maximum meter reading with the selector switch in position 6. If 2-frequency, set F1-F2 switch on control head to F1 position while adjusting L5. Then repeat in F2 position while adjusting trimmer C204 and coil L201.	Receiver crystal frequency, sharp tuning	L5 (L201)	6	Maximum
9	FREQUENCY CHECK -- Transmit the carrier frequency from the transmitter which this receiver is normally intended to receive. A zero meter reading indicates that the receiver is on frequency. Adjust trimmer C110 to obtain a zero meter reading. Check the final setting by rotating C110 back and forth while observing the meter. The reading should go above and below the zero point as the trimmer is rotated. Set C110 for exactly zero meter reading. On 2-frequency receivers, adjust C204 for the number 2 frequency.	Carrier frequency, sharp tuning	C110, C204	4	Zero
10	MULTIPLIER COILS L7 AND L6 -- The signal generator must be set for the exact carrier frequency to be received. To do this follow the procedure outlined below the illustration except select the carrier frequency instead of 12 mc and couple the signal to pin 6 of V103 instead of pin 7, V105. With the generator output coupled loosely to pin 6, V103, adjust L7 and L6 for maximum meter reading (position 1 or 2).	Carrier frequency, sharp tuning	L7 L6	1 or 2	Maximum
11	RF COILS L4, L3 and L2 -- Keep the signal generator set for the carrier frequency as in step 10. Couple the signal loosely to the grid (pin 1) of V101. Adjust L4, L3 and L2 for maximum reading (position 1 or 2).	Carrier freq., sharp tuning	L4, L3 and L2	1 or 2	Maximum
12	ANTENNA COIL L1 -- Connect the signal generator output to the antenna receptacle on the receiver chassis. Use a 6 db, 50 ohm, attenuation pad between the generator and the receiver input. Adjust L1 for maximum reading.	Carrier freq., sharp tuning	L1	1 or 2	Maximum
13	IGNITION NOISE ADJUSTMENT -- Install the receiver in the vehicle. Start the vehicle engine and allow it to run while making the adjustments. Turn the receiver ON and allow it to warm up for five minutes. Radiate a carrier frequency signal from a transmitter, signal generator or test set (see test set instruction manual). The signal should be just strong enough to produce quieting (20 to 30 db). Turn VOLUME control on control head to normal usable level. Plug the test set metering cable into the METER receptacle on the receiver. Set the selector switch to position 2 and note the meter reading. Adjust coil L14 very slightly to reduce audible ignition noise. DO NOT reduce the meter reading more than one-half microampere.	Carrier freq., slight adj.	L14	2	Reduce audible noise

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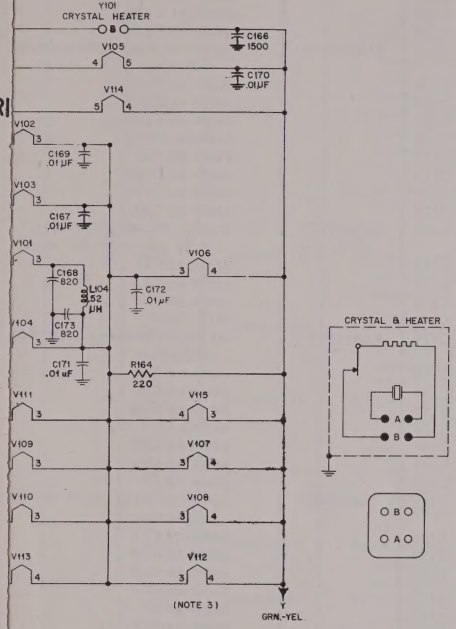
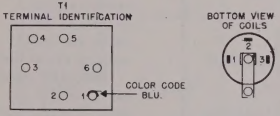
1ST C





MODEL TABLE

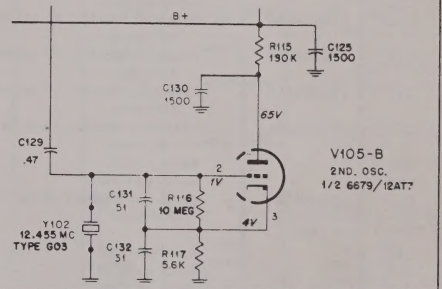
	ONE - FREQUENCY	CHASSIS SUFFIX	FREQ. RANGE	CHANNEL SPACING
TA237W	TRD1171AA / TA237W-L	5	144-152MC	60KC
	TRD1172AA / TA237W-H	5	152-174MC	60KC
TA237S	TRD1171AB / TA237S-L	6	144-152MC	30KC
	TRD1172AB / TA237S-H	6	152-174MC	30KC

→ TO SQUELCH CONTROL

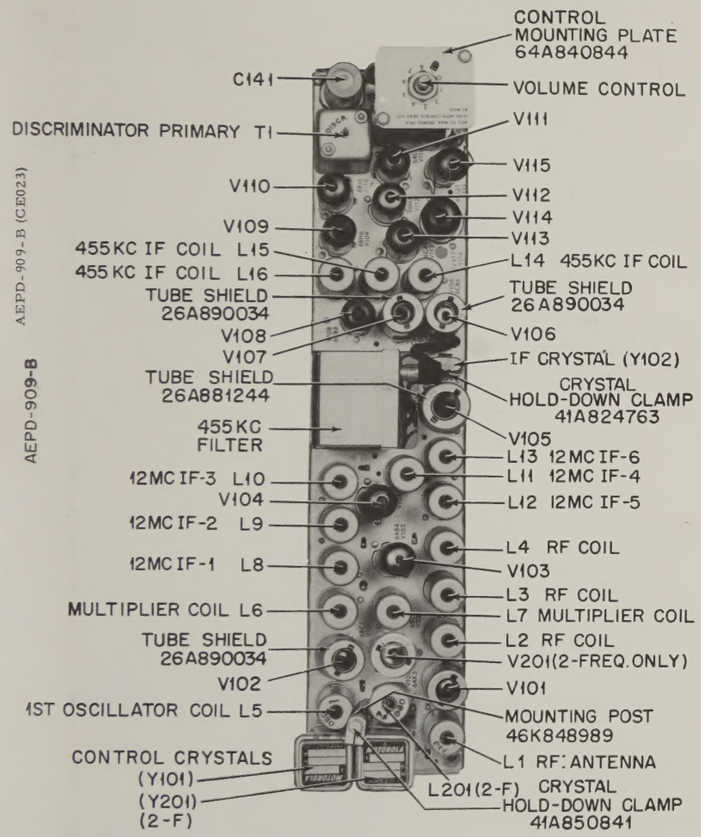
V.

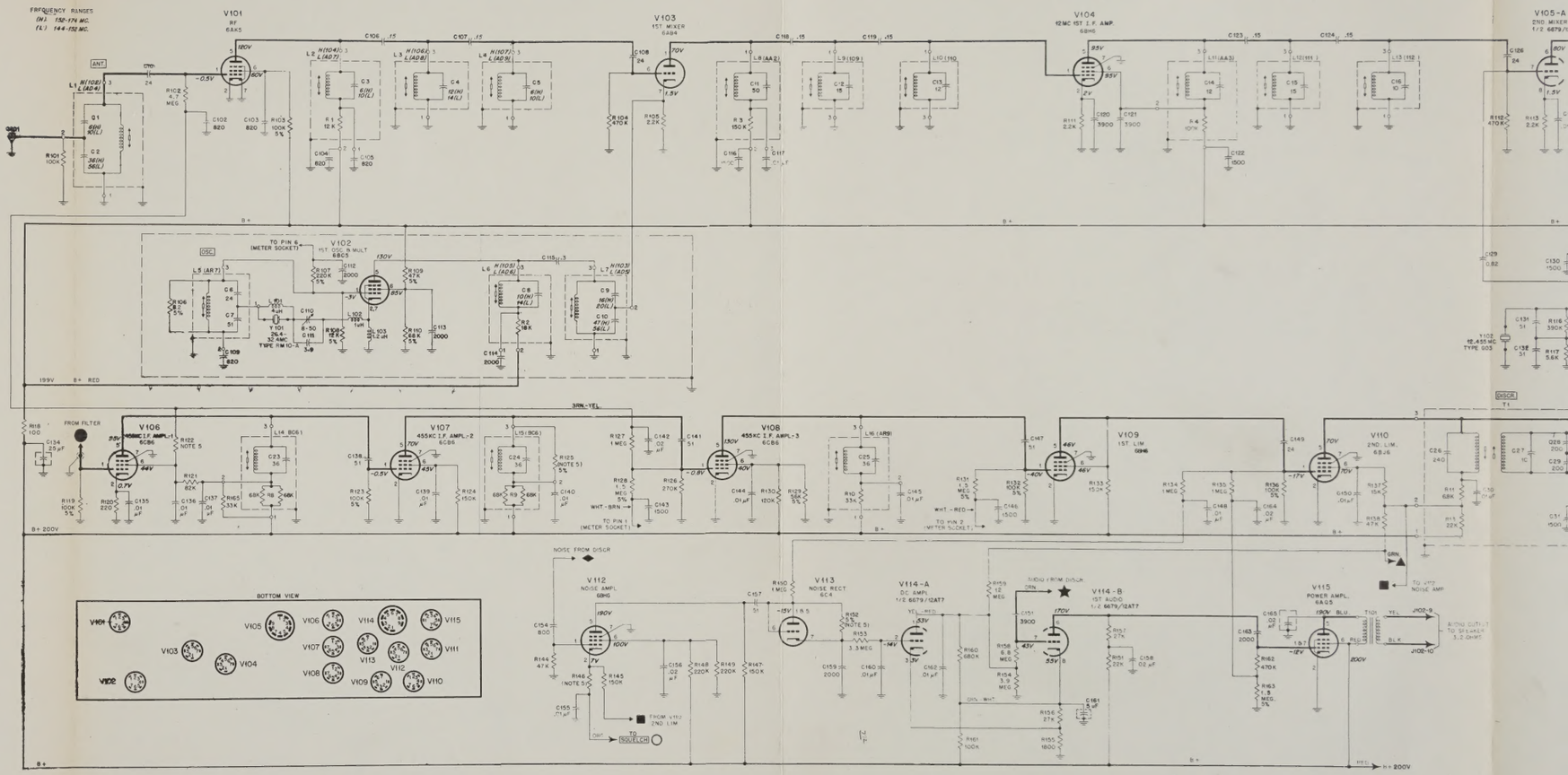
REVISIONS

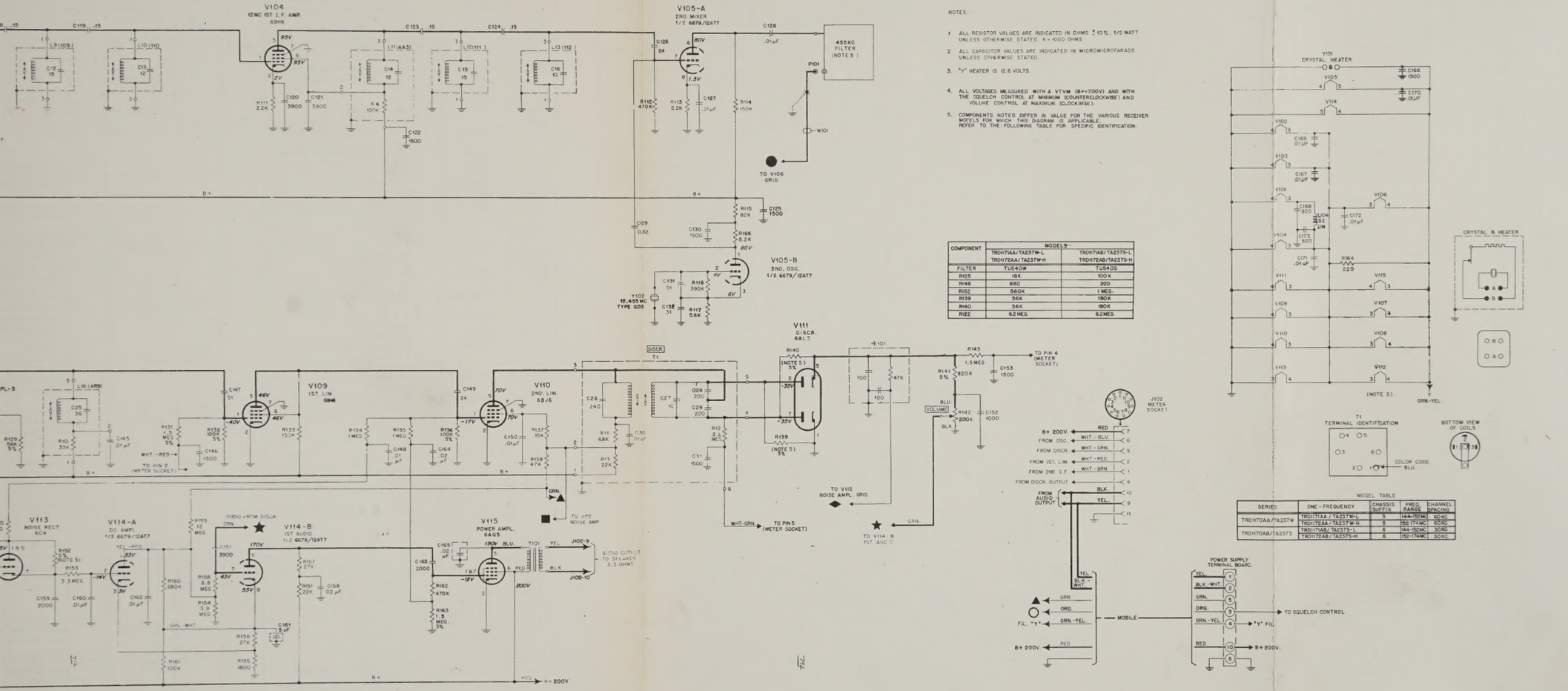
DIAG. ISSUE	CHASSIS SUFFIX	REF. SYMBOL	CHANGE	LOCATION
63E854792-F	TRD1171AA/ TA237W-L-4 TRD1172AA/ TA237W-H-4 TRD1171AB/ TA237S-L-5 TRD1172AB/ TA237S-H-5	R165	33K RESISTOR ADDED	V106-6
63E854792-G	TRD1171AA/ TA237W-L-5	R166	6.8K RESISTOR ADDED	2ND OSC.
	TRD1172AA/ TA237W-H-5	R115	WAS 180K	
	TRD1171AB/ TA237S-L-6 TRD1172AB/ TA237S-H-6	R116	WAS 10 MEG	
		C129	WAS .47 uuf AND RELOCATED CIRCUIT WAS AS SHOWN BELOW	
O			MODEL TA237X REMOVED	MODEL TABLE



Single Frequency Receiver
Schematic Diagram and Parts Location Detail
Motorola No. 63E862486-O
11/3/59-RCS


CONTROL MOUNTING PLATE 64A840844
C141
VOLUME CONTROL
DISCRIMINATOR PRIMARY T1
V111
V115
V110
V112
V114
V109
V113
455KC IF COIL L15
L14 455KC IF COIL
455KC IF COIL L16
TUBE SHIELD 26A890034
TUBE SHIELD 26A890034
V108
V106
V107
IF CRYSTAL (Y102)
TUBE SHIELD 26A881244
CRYSTAL HOLD-DOWN CLAMP 41A824763
455KC FILTER
V105
L13 12MC IF-6
12MC IF-3 L10
L11 12MC IF-4
V104
L12 12MC IF-5
12MC IF-2 L9
L4 RF COIL
12MC IF-1 L8
V103
L3 RF COIL
MULTIPLIER COIL L6
L7 MULTIPLIER COIL
TUBE SHIELD 26A890034
L2 RF COIL
V201(2-FREQ.ONLY)
V102
V101
1ST OSCILLATOR COIL L5
MOUNTING POST 46K848989
L1 RF ANTENNA
CONTROL CRYSTALS (Y101) (Y201) (2-F)
L201(2-F) CRYSTAL HOLD-DOWN CLAMP 41A850841


FREQUENCY RANGES
(H) 152-174 MC.
(L) 144-152 MC.
V101
RF
6AK5
V103
1ST MIXER
6AB4
V104
12 MC 1ST I.F. AMP.
6BH6
V102
1ST OSC. & MULT
6BC5
Y101
26.4-32.4MC
TYPE RM10-E
V106
455KC I.F. AMPL-1
6CB6
V107
455KC I.F. AMPL-2
6CB6
V108
455KC I.F. AMPL-3
6CB6
V109
1ST LIM.
6BH6
V110
2ND LIM.
6BJ6
V112
NOISE AMPL.
6BH6
V113
NOISE RECT.
6C4
V114-A
DC AMPL.
1/2 6679/12AT7
V114-B
1ST AUDIO
1/2 6679/12AT7
V115
POWER AMPL.
6AQ5
V105-A
2ND MIXER
1/2 6679
Y102
12.455 MC
TYPE G03
BOTTOM VIEW
199V
B+ RED
B+ 200V
B+
3RN-YEL
WHT-BRN
WHT-RED
GRN
YEL
BLK
BLU
NOISE FROM DISCR
SQUELCH
TO SPEAKER 3.2 OHMS



NOTES:

1. ALL RESISTOR VALUES ARE INDICATED IN OHMS ±10%, 1/2 WATT UNLESS OTHERWISE STATED. K = 1000 OHMS
2. ALL CAPACITOR VALUES ARE INDICATED IN MICROMICROFARADS UNLESS OTHERWISE STATED.
3. "Y" HEATER IS 12.6 VOLTS.
4. ALL VOLTAGES MEASURED WITH A VTVM (B+=200V) AND WITH THE SQUELCH CONTROL AT MINIMUM (COUNTERCLOCKWISE) AND VOLUME CONTROL AT MAXIMUM (CLOCKWISE).
5. COMPONENTS NOTED DIFFER IN VALUE FOR THE VARIOUS RECEIVER MODELS FOR WHICH THIS DIAGRAM IS APPLICABLE. REFER TO THE FOLLOWING TABLE FOR SPECIFIC IDENTIFICATION.

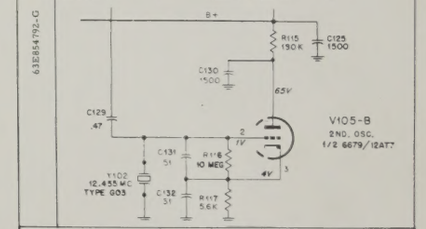
COMPONENT	MODELS	
	TRDH7AAA/TA237W-L TRDH72AA/TA237W-H	TRDH71AB/TA237S-L TRDH72AB/TA237S-H
FILTER	TU540W	TU540S
R125	18K	100 K
R46	680	200
R152	560K	1 MEG.
R139	56K	180K
R140	56K	180K
R122	8.2 MEG.	8.2 MEG.

MODEL TABLE

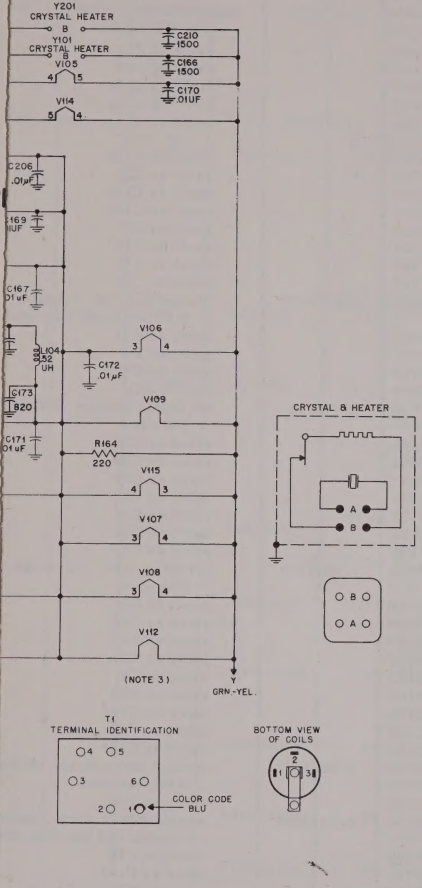
SERIES	ONE-FREQUENCY	CHASSIS SUFFIX	FREQ. RANGE	CHANNEL SPACING
TRDH70AA/TA237W	TRDH71AA / TA237W-L	5	144-152 MC	60 KC
	TRDH72AA / TA237W-H	5	150-174 MC	60 KC
TRDH70AB/TA237S	TRDH71AB/TA237S-L	6	144-152 MC	30 KC
	TRDH72AB/TA237S-H	6	152-174 MC	30 KC

REVISIONS

DIAG ISSUE	CHASSIS SUFFIX	REF. SYMBOL	CHANGE	LOCATION
63E854792-F	TRD1171AA/ TA237W-L-4 TRD1172AA/ TA237W-H-4 TRD1171AB/ TA237S-L-5 TRD1172AB/ TA237S-H-5	R165	33K RESISTOR ADDED	V106-6
63E854792-G	TRD1171AA/ TA237W-L-5 TRD1172AA/ TA237W-H-5 TRD1171AB/ TA237S-L-6 TRD1172AB/ TA237S-H-6	R166	6.8K RESISTOR ADDED	2ND OSC.
		R115	WAS 180K	
		R116	WAS 10 MEG	
		C129	WAS .47 mfd AND RELOCATED	
			CIRCUIT WAS AS SHOWN BELOW	
O			MODEL TA237X REMOVED	MODEL TABLE



Single Frequency Receiver
Schematic Diagram and Parts Location Detail
Motorola No. 63E862486-O
11/3/59-RCS



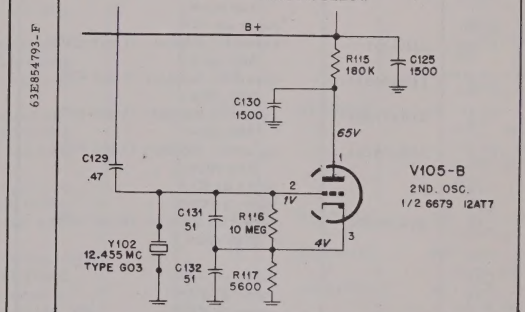
DISCR

AEPD-909-B

1ST

REVISIONS

DIAG. ISSUE	CHASSIS SUFFIX	REF. SYMBOL	CHANGE	LOCATION
63E854793-E	TRD1171AC/ TA237W-R2-L-4 TRD1172AC/ TA237W-R2-H-4 TRD1171AD/ TA237S-R2-L-5 TRD1172AD/ TA237S-R2-H-5	R165	33K RESISTOR ADDED	V106-6
63E854793-F	TRD1170AC/ TA237W-R2-5 TRD1170AD/ TA237S-R2-6	R166	6.8K RESISTOR ADDED	2ND OSC.
		R115	WAS 180K	
		R116	WAS 10 MEG	
		C129	WAS .47 uuf AND RELOCATED. CIRCUIT WAS AS SHOWN BELOW	
O			MODEL TA237X REMOVED	MODEL TABLE



MODEL TABLE

	TWO-FREQUENCY	CHASSIS SUFFIX	FREQ. RANGE	CHANNEL SPACING
R2	TRD1171AC/TA237W-R2-L	5	144-152 MC	60KC
	TRD1172AC/TA237W-R2-H	5	152-174 MC	60KC
R2	TRD1171AD/TA237S-R2-L	6	144-152 MC	30KC
	TRD1172AD/TA237S-R2-H	6	152-174 MC	30KC

Two-Frequency Receiver
Schematic Diagram and Parts Location Detail
Motorola No. 63E862487-O
11/3/59-RCS

SCHEMATIC DIAGRAM PARTS LIST

Reference:
Schematic Diagram
63E862486-O

REFERENCE SYMBOL	MOTOROLA PART No.	DESCRIPTION
		CAPACITOR, fixed: unless otherwise stated
C1L	21R490602	ceramic; tubular; 10 uuf ±5%; 500 vdcw
C1H	21R400072	ceramic; tubular; 6 uuf ±.5 uuf; 500 vdcw
C2L	21R114052	ceramic; tubular; 56 uuf ±10%; 500 vdcw
C2H	21R87127	ceramic; tubular; 36 uuf ±5%; 500 vdcw
C3L		same as C1L
C3H	21R121918	ceramic; tubular; 6 uuf ±.5 uuf; 500 vdcw
C4L	21R836528	ceramic; disc; 14 uuf ±5%; 500 vdcw
C4H	21R490605	ceramic; tubular; 12 uuf ±5%; 500 vdcw
C5L		same as C1L
C5H		same as C1H
C6	21R840716	ceramic; disc; 24 uuf ±5%; 500 vdcw
C7	21R840711	molded silver mica; 51 uuf ±5%; 500 vdcw
C8L	21R836528	ceramic; disc; 14 uuf ±5%; 500 vdcw
C8H	21R791561	fixed; ceramic; tubular; 6 uuf ±.5 uuf; 500 vdcw
C9L	21R31492	ceramic; tubular; 20 uuf ±5%; 500 vdcw
C9H	21R119296	ceramic; tubular; 16 uuf ±5%; 500 vdcw
C10L		same as C2L
C10H	21R114153	ceramic; tubular; 47 uuf ±10%; 500 vdcw
C11	21R474573	ceramic; tubular; 50 uuf ±5%; 500 vdcw
C12	21R475262	ceramic; tubular; 15 uuf ±5%; 500 vdcw
C13	21R475261	ceramic; tubular; 12 uuf ±5%; 500 vdcw
C14		same as C13
C15		same as C12
C16	21R890124	ceramic; tubular; 10 uuf ±5%; 500 vdcw
C23		same as C2H
C24		same as C2H
C25		same as C2H
C26	21K840048	molded silver mica; 240 uuf ±5%; 500 vdcw
C27	21K840811	ceramic; disc; 10 uuf ±5%; 500 vdcw
C28	21K840812	molded silver mica; 200 uuf ±5%; 500 vdcw
C29		same as C28
C30	21B801139	ceramic; disc; .01 uf +80-20%; 600 vdcw
C31	21B800801	ceramic; disc; 1500 uuf GMV +100% max.; 500 vdcw
C101	21K840365	cer.; disc; 24 uuf ±5%; 500 vdcw
C102	21B837745	cer.; disc; 820 uuf ±10%; 500 vdcw
C103		same as C102
C104		same as C102
C105		same as C102
C106	21K881064	mld. phen. tub.; .15 uuf ±5%; 500 vdcw
C107		same as C106
C108		same as C101
C109		same as C102
C110	20B840719	var.; air; 8 uuf min. to 50 uuf max.
C111	21K838284	cer.; disc; 3.9 uuf ±.25 uuf; 250 vdcw

REFERENCE SYMBOL	MOTOROLA PART No.	DESCRIPTION
		CAPACITOR, fixed: cont'd.
C112	21K837746	ceramic; disc; 2000 uuf ±10%; 500 vdcw
C113		same as C112
C114		same as C112
C115	21K830201	molded phenolic; tubular; .3 uuf ±5%; 500 vdcw
C116		same as C31
C117		same as C30
C118		same as C106
C119		same as C106
C120	21K837996	ceramic; disc; 3900 uuf ±10%; 500 vdcw
C121		same as C120
C122		same as C31
C123		same as C106
C124		same as C106
C125		same as C31
C126		same as C101
C127		same as C30
C128		same as C30
C129	21K475679	molded phenolic; tubular; 0.82 uuf ±10%; 500 vdcw
C130		same as C31
C131		same as C7
C132		same as C7
C133		NOT USED
C134	8A892986	oil filled; tubular; .25 uf ±20%; 400 vdcw
C135		same as C30
C136		same as C30
C137		same as C30
C138		same as C7
C139		same as C30
C140		same as C30
C141		same as C7
C142	21B401029	ceramic; disc; .02 uf +80-20%; 600 vdcw
C143		same as C31
C144		same as C30
C145		same as C30
C146		same as C31
C147		same as C7
C148		same as C30
C149		same as C101
C150		same as C30
C151		same as C120
C152	21K847601	molded silver mica; 1000 uuf ±5%; 500 vdcw
C153		same as C31
C154	21K840049	molded silver mica; phenolic coated; 800 uuf ±5%; 300 vdcw
C155		same as C30
C156		same as C142
C157		same as C7
C158		same as C142
C159		same as C112
C160		same as C30
C161	23K890624	electrolytic; tubular; 5 uf +100-15%, 150 vdcw
C162		same as C30
C163		same as C112
C164		same as C142
C165	8K85984	oil filled; tubular; .02 uf ±20%; 400 vdcw
C166		same as C31
C167		same as C30
C168		same as C102
C169		same as C30
C170		same as C30
C171		same as C30
C172		same as C30
C173		same as C102

REFERENCE SYMBOL	MOTOROLA PART No.	DESCRIPTION
		CAPACITOR-RESISTOR ASSEMBLY, tubular; consisting of:
E101	21K842354	Dual CAPACITOR: printed circuit, silver paint on ceramic form, each section 100 uuf; 300 vdcw One RESISTOR; fixed; carbon 47K ±20%
J101	9C87120	CONNECTOR, receptacle: female; single contact; round molded mica filled phenolic base; for 1/8" diameter male pin connector
J102	9B86864	11 contact; polarized; round molded black plastic base; chassis mounted; does not include 42A821428 RING, connector retainer; ring must be ordered separately
		COIL:
L1L	24K836515	RF: Antenna; base stamped AD4; includes 76A824120 CORE, adjustable tuning and C1L, C2L
L1H	24B824102	RF: Antenna; base stamped 102; includes 76A824120 CORE, adjustable tuning and C1H, C2H
L2L	24K836518	RF: Plate; base stamped AD7; includes 76A824120 CORE, adjustable tuning and C3L, R1
L2H	24B824104	RF: Plate; base stamped 104; includes 76A824120 CORE adjustable tuning and C3H, R1
L3L	24K836519	RF: Coupling; base stamped AD8 includes 76A824120 CORE, adjustable tuning and C4L
L3H	24B824106	RF: Coupling; base stamped 106, includes 76A824120 CORE, adjustable tuning and C4H
L4L	24K836520	RF: Mixer Grid; base stamped AD9; includes 76A824120 CORE, adjustable tuning and C5L
L4H	24K824107	RF: Mixer Grid; base stamped 107; includes 76A824120 CORE, adjustable tuning and C5H
L5	24B840709	RF: 1st Oscillator; base stamped AR7; includes 46K881276 CORE, adjustable tuning; coded ORANGE dot and C6, C7
L6L	24B824105	RF: 1st Multiplier; base stamped 105; includes 76A824120 CORE, adjustable tuning and C8L
L6H	24B838987	RF: 1st Multiplier; base stamped AP7; includes: 76A838181 CORE, adjustable tuning and C8H
L7L	24K836516	RF: Injection; base stamped AD5, includes 76A824120 CORE, adjustable tuning and C9L, C10L
L7H	24K824103	RF: Injection; base stamped 103; includes 76A824120 CORE, adjustable tuning and C9H, C10H
L8	24K834778	IF: 1st mc IF - 1, base stamped AA2; includes 76A824118 CORE, adjustable tuning and C11, R3

REFERENCE SYMBOL	MOTOROLA PART No.	DESCRIPTION
L9	24B824109	COIL IF: 1st mc IF - 2, base stamped 109; includes 76A824118 CORE, adjustable tuning and C12
L10	24B824110	IF: 1st mc IF - 3; base stamped 110; includes 76A824118 CORE, adjustable tuning and C13
L11	24K834779	IF: 1st mc IF - 4; base stamped AA3; includes 76A824118 CORE, adjustable tuning and C14, R4
L12	24K824111	IF: 1st mc IF - 5; base stamped 111; includes 76A824118 CORE, adjustable tuning and C15
L13	24K824112	IF: 1st mc IF - 6; base stamped 112; includes 76A824118 CORE, adjustable tuning and C16
L14	24K854048	IF: 2nd IF - 1; base stamped BC6; includes 46K891110 CORE, adjustable tuning; coded GREEN dot and C23, R9
L15		same as L14 except 2nd IF - 2 and includes C24, R9
L16	24K840842	IF: 2nd IF - 1; base stamped AR9; includes 46K891110 CORE, adjustable tuning; coded GREEN dot and C25, R10
L101	24A840728	RF: choke; 4 microhenry; coded WHT-BLU dot
L102	24B840042	RF: choke; 1 microhenry; coded RED-BLK dot
L103	24K840559	RF: choke; 1.2 microhenry; coded BLK-GRN dot
L104	24A855418	RF: choke; .52 uh
P1	28K849416	CONNECTOR, plug: male; single contact; brown bakelite wafer insulator; cable mounted
		RESISTOR, fixed; carbon; 1/2 w; ins; unless otherwise stated
R1	6R6394	12K ±10%
R2	6R5591	18K ±10%
R3	6R6398	150K ±5%
R4	6R6031	100K ±10%
R5		NOT USED
R6		NOT USED
R7		NOT USED
R8	6R6410	33K ±10%
R9		same as R8
R10		same as R8
R11	6R6428	6.8K ±10%
R12	6R6433	2.2 megohm ±10%
R13	6R6397	22K ±10%
R101	6R6031	100K
R102	6R6446	4.7 megohm ±10%
R103	6R5553	100K ±5%
R104	6R6377	470K ±10%
R105	6R6069	2.2K ±10%
R106	6R400490	8.2K ±5%
R107	6R400066	220K ±5%
R108	6R2075	12K ±5%
R109	6R6048	47K ±10%
R110	6R6479	68K ±5%
R111		same as R105
R112		same as R104
R113		same as R105

REFERENCE SYMBOL	MOTOROLA PART No.	DESCRIPTION
R114		same as R3
R115	6R5644	82K ±10%
R116	6R5646	390K ±10%
R117	6R6117	5.6K ±10%
R118	6R6326	100 ohm ±10%
R119		same as R103
R120	6R6270	220 ohm ±10%
R121		same as R115
R122	6R5585	8.2 megohm ±10%; used only in TA237W and TA237S
R123		same as R103
R124		same as R3
R125	6R488095	18K ±5%; used in TA237W only
	or 6R5553	100K ±5%; used in TA237S only
R126	6R6414	270K ±10%; 1/2 w; ins.
R127	6R6046	1 megohm ±10%
R128	6R400228	1.5 megohm ±5%
R129	6R401006	56K ±5%
R130	6R5631	120K ±10%
R131		same as R128
R132		same as R103
R133		same as R3
R134		same as R127
R135		same as R127
R136		same as R103
R137	6R6477	15K ±10%
R138		same as R109
R139	6R401006	56K ±5%; used in TA237W only
	or 6R2061	180K ±5%; used in TA237S only
R140		same as R139
R141	6R5773	820K ±5%
R142	18K845110	variable: carbon; 200K ±20%; 1/4 w
R143		same as R128
R144	6R5772	47K ±5%
R145		same as R3
R146	6R6040	680 ohm ±10%; used in TA237W only
	or 6R6270	220 ohm ±10%; used in TA237S only
R147		same as R3
R148	6R6407	220K ±10%
R149		same as R148
R150		same as R127
R151		same as R13
R152	6R5796	560K ±5%; used in TA237W only
	or 6R5587	1 meg, ±5%, used in TA237S only
R153	6R6497	3.3 megohm ±10%
R154	6R49010	3.9 megohm ±10%
R155	6R2089	1.8K ±10%
R156	6R6434	27K ±10%
R157		same as R156
R158	6R2097	6.8 megohm ±10%
R159	6R400334	12 megohm ±10%
R160	6R6475	680K ±10%
R161		same as R101
R162		same as R104
R163		same as R128
R164		same as R120
R165		same as R8
R166		same as R11
T1	1V842353	TRANSFORMER, discriminator: base coded BLUE dot; included two 76A821495 CORE, adjustable tuning; coded YELLOW dot and C26, C27, C28, C29, C30, C31, R11, R12 and R13
T101	25K847479	AF: output; 5000 ohm to 3.2 ohm at 55 ma dc

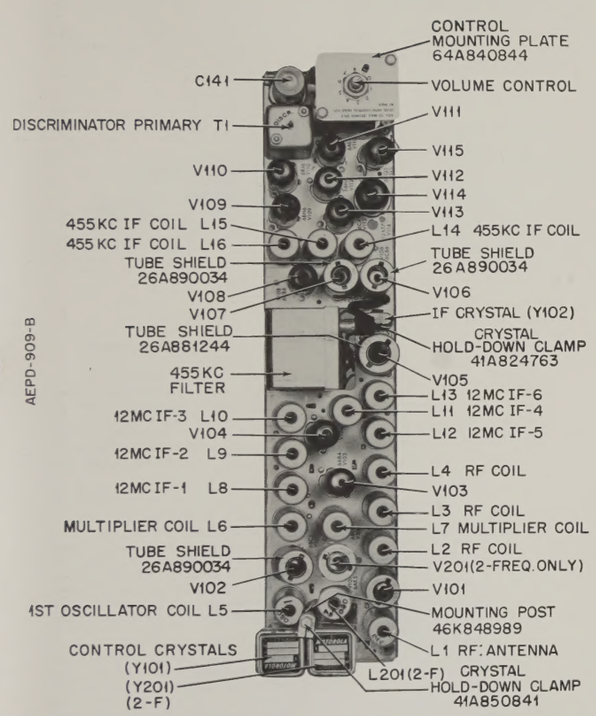
REFERENCE SYMBOL	MOTOROLA PART No.	DESCRIPTION
V101	195T170A01	TUBE, electron: type 6AK5
V102	195T225A01	type 6BC5
V103	195T212A01	type 6AB4
V104	195T175A01	type 6BH6
V105	195T113A02	type 12AT7
V106	195T147A03	type 6CB6
V107		same as V106
V108		same as V106
V109		same as V104
V110	195T176A01	type 6BJ6
V111	195T111A03	type 6AL5
V112		same as V104
V113	195T179A01	type 6C4
V114		same as V105
V115	195T101A01	type 6AQ5
W1	30B849414	LINE; RF transmission: assembly; includes: 30B850951 CABLE, RF: coaxial; RG-58A/U; 4" length required reference part P1
XV101	9B834083	SOCKET, tube: female; 7 contact; miniature; molded mica filled phenolic base; saddle mounting; includes center shield and tube shield base
XV102		same as XV101
XV103	9K87124	7 contact; miniature; molded mica filled phenolic base; saddle mounting; includes center shield
XV104		same as XV103
XV105	9B881243	9 contact; miniature; molded mica filled phenolic base; saddle mounting; includes center shield and tube shield base
XV106		same as XV101
XV107	9B87123	7 contact; miniature; molded black phenolic base; saddle mounting; includes center shield
XV108		same as XV107
XV109		same as XV107
XV110		same as XV107
XV111		same as XV107
XV112		same as XV107
XV113		same as XV107
XV114	9B86868	SOCKET, tube: female; 9 contact; miniature; molded black phenolic base; saddle mounting; includes center shield
XV115		same as XV107
XY101	9K857508	SOCKET, crystal: female; 4 contact; square molded black bakelite base; chassis mounted
XY102	9K861367	2 contact; rectangular; black phenolic base; chassis mounted

REFERENCE SYMBOL	MOTOROLA PART No.	DESCRIPTION
FILTER		
	TU540W	PERMAKAY IF Filter; used in 60 kc models
	TU540S	PERMAKAY IF Filter; used in 30 kc models
CRYSTAL		

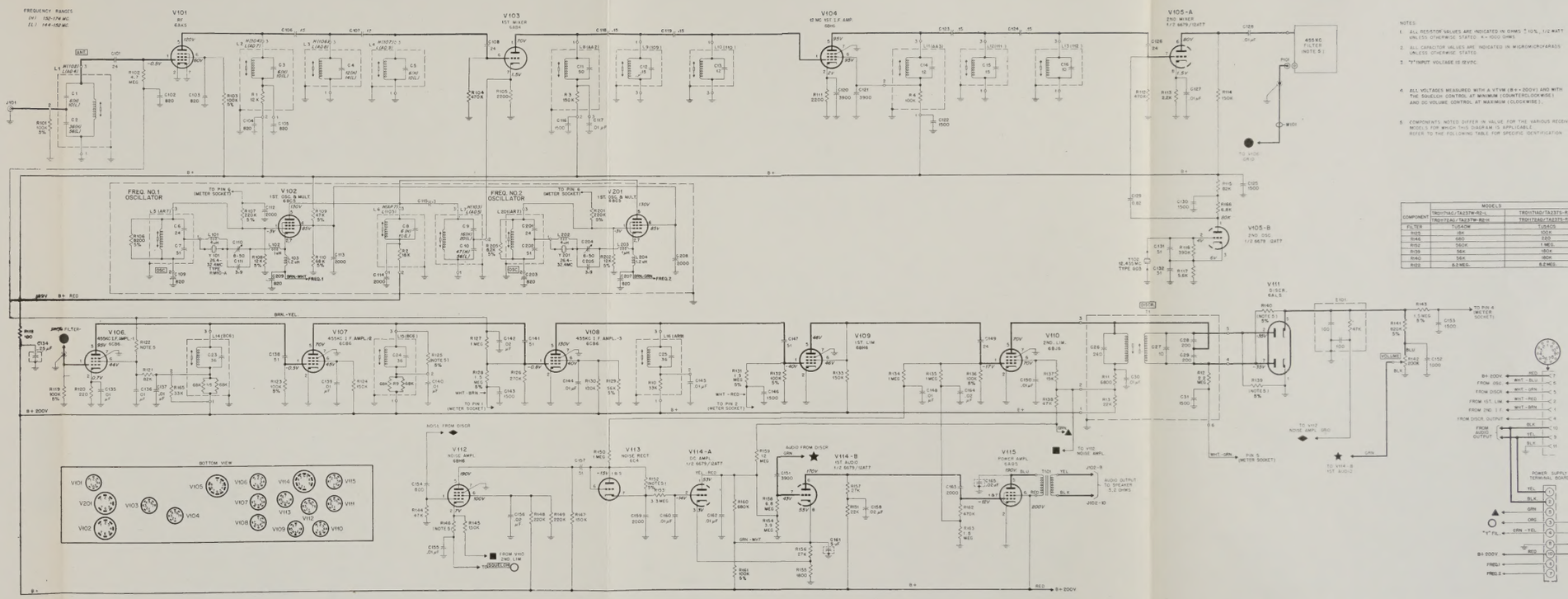
NOTE

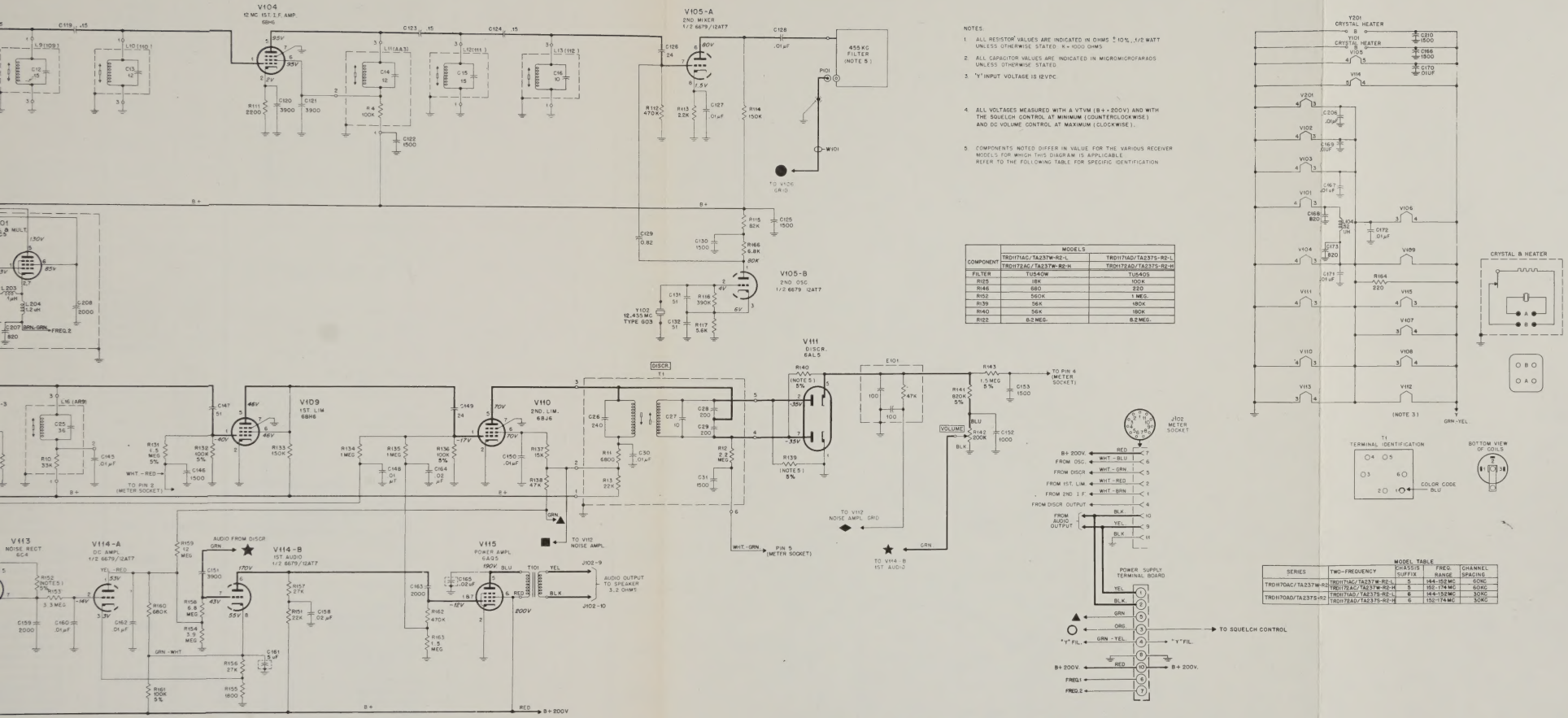
Crystals are part of the Radio Set model. When ordering a receiver chassis only, crystals must be ordered separately. Crystal type number and operating frequency must be specified when ordering crystal.

REFERENCE SYMBOL	MOTOROLA PART No.	DESCRIPTION
		CRYSTAL UNIT, quartz:
Y101	RM10-A	Receiver Control; for 144-174 mc carrier frequency; includes 12 volt heater unit
Y102	Type G03	Receiver IF; 12.455 mc


CONTROL MOUNTING PLATE 64A840844
C141
VOLUME CONTROL
DISCRIMINATOR PRIMARY T1
V111
V115
V110
V112
V109
V114
455KC IF COIL L15
V113
455KC IF COIL L16
L14 455KC IF COIL
TUBE SHIELD 26A890034
TUBE SHIELD 26A890034
V108
V106
V107
IF CRYSTAL (Y102)
TUBE SHIELD 26A881244
CRYSTAL HOLD-DOWN CLAMP 41A824763
455KC FILTER
V105
L13 12MC IF-6
L11 12MC IF-4
12MC IF-3 L10
V104
L12 12MC IF-5
12MC IF-2 L9
L4 RF COIL
12MC IF-1 L8
V103
L3 RF COIL
MULTIPLIER COIL L6
L7 MULTIPLIER COIL
TUBE SHIELD 26A890034
L2 RF COIL
V201(2-FREQ.ONLY)
V102
V101
1ST OSCILLATOR COIL L5
MOUNTING POST 46K848989
L1 RF ANTENNA
CONTROL CRYSTALS (Y101) (Y201) (2-F)
L201(2-F) CRYSTAL HOLD-DOWN CLAMP 41A850841

AEPD-909-B


V101
V103
V104
V105-A
V105-B
V106
V107
V108
V109
V110
V111
V112
V113
V114-A
V114-B
V115
V102
V201
FREQ. NO.1 OSCILLATOR
FREQ. NO.2 OSCILLATOR
BOTTOM VIEW
455KC FILTER (NOTE 5)
NOTES:
1. ALL RESISTOR VALUES ARE INDICATED IN OHMS (K=1000, M=1,000,000) UNLESS OTHERWISE STATED. K=1000 OHMS.
2. ALL CAPACITOR VALUES ARE INDICATED IN MMFD/MICROFARADS UNLESS OTHERWISE STATED.
3. "S" INPUT VOLTAGE IS 85VDC.
4. ALL VOLTAGES MEASURED WITH A VTVM (8+ = 200V) AND WITH THE SQUELCH CONTROL AT MINIMUM (COUNTERCLOCKWISE) AND DC VOLUME CONTROL AT MAXIMUM (CLOCKWISE).
5. COMPONENTS NOTED DIFFER IN VALUE FOR THE VARIOUS RECEIVER MODELS FOR WHICH THIS DIAGRAM IS APPLICABLE. REFER TO THE FOLLOWING TABLE FOR SPECIFIC IDENTIFICATION.
MODELS
COMPONENT
TRDHTNAD/TA23TM-RD-L
TRDHTBAD/TA23TM-RB-H
TRDHTBAD/TA23TS-R
FILTER
TUS40M
TUS40S
R125
18K
100K
R146
680
220
R152
560K
1 MEG.
R139
56K
150K
R140
56K
180K
R122
8.2 MEG.
6.8 MEG.



NOTES:

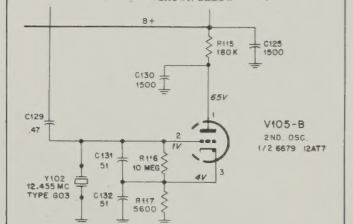
1. ALL RESISTOR VALUES ARE INDICATED IN OHMS ± 10%, , 1/2 WATT UNLESS OTHERWISE STATED. K = 1000 OHMS.
2. ALL CAPACITOR VALUES ARE INDICATED IN MICROMICROFARADS UNLESS OTHERWISE STATED.
3. "X" INPUT VOLTAGE IS 12 VDC.
4. ALL VOLTAGES MEASURED WITH A VTVM (B+ = 200V) AND WITH THE SQUELCH CONTROL AT MINIMUM (COUNTERCLOCKWISE) AND DC VOLUME CONTROL AT MAXIMUM (CLOCKWISE).
5. COMPONENTS NOTED DIFFER IN VALUE FOR THE VARIOUS RECEIVER MODELS FOR WHICH THIS DIAGRAM IS APPLICABLE. REFER TO THE FOLLOWING TABLE FOR SPECIFIC IDENTIFICATION

COMPONENT	MODELS	
	TRD1171AC/TA237W-R2-L TRD1172AC/TA237W-R2-H	TRD1171AD/TA237S-R2-L TRD1172AD/TA237S-R2-H
FILTER	TU540W	TU540S
R125	18K	100K
R146	680	220
R152	560K	1 MEG.
R139	56K	180K
R140	56K	180K
R122	6.2 MEG.	6.2 MEG.

SERIES	TWO-FREQUENCY	MODEL TABLE CHASSIS SUFFIX	FREQ. RANGE	CHANNEL SPACING
TRD1170AC/TA237W-R2	TRD1171AC/TA237W-R2-L	5	144-152 MC	60KC
	TRD1172AC/TA237W-R2-H	5	152-174 MC	60KC
TRD1170AD/TA237S-R2	TRD1171AD/TA237S-R2-L	6	144-152 MC	30KC
	TRD1172AD/TA237S-R2-H	6	152-174 MC	30KC

REVISIONS

DIAG. ISSUE	CHASSIS SUFFIX	REF. SYMBOL	CHANGE	LOCATION
63E854793-E	TRD1171AC/ TA237W-R2-L-4 TRD1172AC/ TA237W-R2-H-4 TRD1171AD/ TA237S-R2-L-5 TRD1172AD/ TA237S-R2-H-5	R165	33K RESISTOR ADDED	V106-6
63E854793-F		R166	6.8K RESISTOR ADDED	
	TRD1170AC/ TA237W-R2-5 TRD1170AD/ TA237S-R2-6	R115	WAS 180K	2ND OSC.
		R116	WAS 10 MEG	
		C129	WAS .47 uuf AND RELOCATED. CIRCUIT WAS AS SHOWN BELOW	
O			MODEL TA237X REMOVED	MODEL TABLE

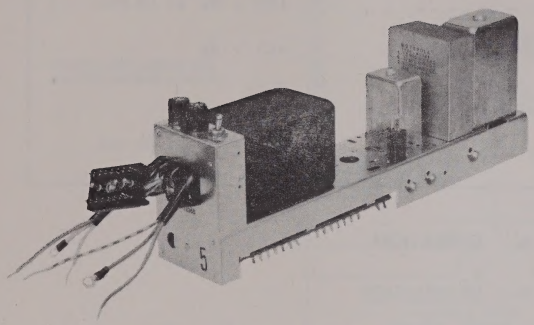


Two-Frequency Receiver
Schematic Diagram and Parts Location Detail
Motorola No. 63E862487-O
11/3/59-RCS

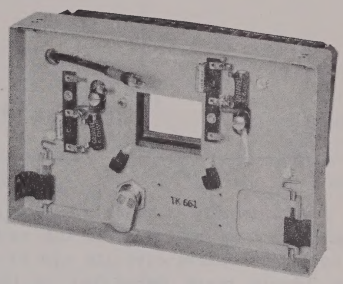
TRANSISTORIZED POWER SUPPLY

CE978C

CE1063A



POWER SUPPLY



TRANSISTORS AND POWER SUPPLY COMPONENTS ON RADIO SET FRONT PANEL

1. INTRODUCTION

The TPN6000BA is a fully transistorized power supply with a common emitter circuit. It provides all the plate, screen and bias voltages required by the mobile radio transmitter and receiver. The transistorized circuitry replaces the vibrator circuits commonly used in mobile radio applications.

a. Basic Principle

The transistor circuit of the power supply is essentially a single-pole, double-throw switch, operating back and forth continuously. This switching action interrupts the flow of battery current through the power supply transformer primary. Interrupting the dc gives the effect of ac and the transformer windings step up the voltages as required for the rectified outputs.

The input is connected to the transistor emitters. The opposite ends of the transformer are connected to the transistor collectors, which alternately open and close the circuit to the dc input. The current flows first through one transistor, then through the other, giving the effect of an alternating current. This circuit effectively duplicates the action of a vibrator and is used to replace the vibrator circuit.

b. Advantages

The transistorized power supply has several advantages over the conventional vibrator supply. These are: lifespan of the transistor exceeds that of the finest vibrator, elimination of vibrator hash and lower battery drain requirements.

In addition, the transistor circuit has a built-in protection factor not found in vibrator supplies. A short in the output does not damage the transistors.

2. DESCRIPTION

The power supply is designed for a 12-volt negative or positive ground electrical system.

SCHEMATIC DIAGRAM PARTS LIST

Reference:
Schematic Diagram
63E862487-O

REFERENCE SYMBOL	MOTOROLA PART No.	DESCRIPTION
		CAPACITOR, fixed: unless otherwise stated
C1L	21R490602	ceramic; tubular; 10 uuf ±5%; 500 vdcw
C1H	21R400072	ceramic; tubular; 6 uuf ±.5 uuf; 500 vdcw
C2L	21R114052	ceramic; tubular; 56 uuf ±10%; 500 vdcw
C2H	21R87127	ceramic; tubular; 36 uuf ±5%; 500 vdcw
C3L		same as C1L
C3H	21R121918	ceramic; tubular; 6 uuf ±.5 uuf; 500 vdcw
C4L	21K836528	ceramic; disc; 14 uuf ±5%; 500 vdcw
C4H	21R490605	ceramic; tubular; 12 uuf ±5%; 500 vdcw
C5L		same as C1L
C5H		same as C1H
C6	21K840716	ceramic; disc; 24 uuf ±5%; 500 vdcw
C7	21K840711	molded silver mica; 51 uuf ±5%; 500 vdcw
C8L	21K836528	ceramic; disc; 14 uuf ±5%; 500 vdcw
C8H	21R791561	fixed; ceramic; tubular; 6 uuf ±.5 uuf; 500 vdcw
C9L	21R31492	ceramic; tubular; 20 uuf ±5%; 500 vdcw
C9H	21R119296	ceramic; tubular; 16 uuf ±5%; 500 vdcw
C10L		same as C2L
C10H	21R114153	ceramic; tubular; 47 uuf ±10%; 500 vdcw
C11	21R474573	ceramic; tubular; 50 uuf ±5%; 500 vdcw
C12	21R475262	ceramic; tubular; 15 uuf ±5%; 500 vdcw
C13	21R475261	ceramic; tubular; 12 uuf ±5%; 500 vdcw
C14		same as C13
C15		same as C12
C16	21R890124	ceramic; tubular; 10 uuf ±5%; 500 vdcw
C23		same as C2H
C24		same as C2H
C25		same as C2H
C26	21K840048	molded silver mica; 240 uuf ±5%; 500 vdcw
C27	21K840811	ceramic; disc; 10 uuf ±5%; 500 vdcw
C28	21K840812	molded silver mica; 200 uuf ±5%; 500 vdcw
C29		same as C28
C30	21B801139	ceramic; disc; .01 uf +80-20%; 600 vdcw
C31	21B800801	ceramic; disc; 1500 uuf GMV +100% max.; 500 vdcw
C101	21K840365	cer.; disc; 24 uuf ±5%; 500 vdcw
C102	21B837745	cer.; disc; 820 uuf ±10%; 500 vdcw
C103		same as C102
C104		same as C102
C105		same as C102
C106	21K881064	mld. phen. tub.; .15 uuf ±5%; 500 vdcw
C107		same as C106
C108		same as C101
C109		same as C102
C110	20B840719	var.; 8 uuf min. to 50 uuf max.
C111	21K838284	cer.; disc; 3.9 uuf ±.25 uuf; 250 vdcw

REFERENCE SYMBOL	MOTOROLA PART No.	DESCRIPTION
		CAPACITOR, fixed: cont'd.
C112	21K837746	ceramic; disc; 2000 uuf ±10%; 500 vdcw
C113		same as C112
C114		same as C112
C115	21K830201	molded phenolic; tubular; .3uuf ±5%; 500 vdcw
C116		same as C31
C117		same as C30
C118		same as C106
C119		same as C106
C120	21K837996	ceramic; disc; 3900 uuf ±10%; 500 vdcw
C121		same as C120
C122		same as C31
C123		same as C106
C124		same as C106
C125		same as C31
C126		same as C101
C127		same as C30
C128		same as C30
C129	21K475679	molded phenolic; tubular; 0.82 uuf ±10%; 500 vdcw
C130		same as C31
C131		same as C7
C132		same as C7
C133		NOT USED
C134	8A892986	oil filled; tubular; .25 uf ±20%; 400 vdcw
C135		same as C30
C136		same as C30
C137		same as C30
C138		same as C7
C139		same as C30
C140		same as C30
C141		same as C7
C142	21B401029	ceramic; disc; .02 uf +80-20%; 600 vdcw
C143		same as C31
C144		same as C30
C145		same as C30
C146		same as C31
C147		same as C7
C148		same as C30
C149		same as C101
C150		same as C30
C151		same as C120
C152	21K847601	molded silver mica; 1000 uuf ±5%; 500 vdcw
C153		same as C31
C154	21K840049	molded silver mica; phenolic coated; 800 uuf ±5%; 300 vdcw
C155		same as C30
C156		same as C142
C157		same as C7
C158		same as C142
C159		same as C112
C160		same as C30
C161	23K890624	electrolytic; tubular; 5 uf +100-15%; 150 vdcw
C162		same as C30
C163		same as C112
C164		same as C142
C165	8K85984	oil filled; tubular; .02 uf ±20%; 400 vdcw
C166		same as C31
C167		same as C30
C168		same as C102
C169		same as C30
C170		same as C30
C171		same as C30
C172		same as C30
C173		same as C102
C201		same as C6
C202		same as C7

REFERENCE SYMBOL	MOTOROLA PART No.	DESCRIPTION
		CAPACITOR, fixed: cont'd.
C203		same as C102
C204		same as C110
C205		same as C111
C206		same as C30
C207		same as C102
C208		same as C112
C209		same as C102
C210		same as C31
E101	21K842354	CAPACITOR-RESISTOR ASSEMBLY, tubular; consisting of: Dual CAPACITOR; printed circuit, silver paint on ceramic form, each section 100 uuf; 300 vdcw One RESISTOR; fixed; carbon 47K ±20%
J101	9C87120	CONNECTOR, receptacle: female; single contact; round molded mica filled phenolic base; for 1/8" diameter male pin connector
J102	9C86864	11 contact; polarized; round molded black plastic base; chassis mounted; does not include 42A821428 RING, connector retainer; ring must be ordered separately
		COIL,
L1L	24K836515	RF: Antenna; base stamped AD4; includes 76A824120 CORE, adjustable tuning and C1L, C2L;
L1H	24B824102	RF: Antenna; base stamped 102; includes 76A824120 CORE, adjustable tuning and C1H, C2H
L2L	24K836518	RF: Plate; base stamped AD7; includes 76A824120 CORE, adjustable tuning and C3L, R1
L2H	24B824104	RF: Plate; base stamped 104; includes 76A824120 CORE adjustable tuning and C3H, R1
L3L	24K836519	RF: Coupling; base stamped AD8 includes 76A824120 CORE, adjustable tuning and C4L
L3H	24B824106	RF: Coupling; base stamped 106; includes 76A824120 CORE, adjustable tuning and C4H
L4L	24K836520	RF: Mixer Grid; base stamped AD9; includes 76A824120 CORE, adjustable tuning and C5L
L4H	24K824107	RF: Mixer Grid; base stamped 107; includes 76A824120 CORE, adjustable tuning and C5H
L5	24B840709	RF: 1st Oscillator; base stamped AR7; includes 46K881276 CORE, adjustable tuning; coded ORANGE dot and C6, C7
L6L	24B824105	RF: 1st Multiplier; base stamped 105; includes 76A824120 CORE, adjustable tuning and C8L.
L6H	24B838987	RF: 1st Multiplier; base stamped AP7; includes; 76A838181 CORE, adjustable tuning and C8H

REFERENCE SYMBOL	MOTOROLA PART No.	DESCRIPTION
		COIL,
L7L	24K836516	RF: Injection; base stamped AD5; includes 76A824120 CORE, adjustable tuning and C9L, C10L
L7H	24K824103	RF: Injection; base stamped 103; includes 76AR24120 CORE, adjustable tuning and C9H, C10H
L8	24K834778	IF: 1st mc IF - 1; base stamped AA2; includes 76A824118 CORE, adjustable tuning and C11, R3
L9	24B824109	IF: 1st mc IF - 2; base stamped 109; includes 76A824118 CORE, adjustable tuning and C12
L10	24B824110	IF: 1st mc IF - 3; base stamped 110; includes 76A824118 CORE, adjustable tuning and C13
L11	24K834779	IF: 1st mc IF - 4; base stamped AA3; includes 76A824118 CORE, adjustable tuning and C14, R4
L12	24K824111	IF: 1st mc IF - 5; base stamped 111; includes 76A824118 CORE, adjustable tuning and C15
L13	24K824112	IF: 1st mc IF - 6; base stamped 112; includes 76A824118 CORE, adjustable tuning and C16
L14	24K854048	IF: 2nd IF - 1; base stamped BC6; includes 46K891110 CORE, adjustable tuning; coded GREEN dot and C23, R8
L15		same as L14 except 2nd IF - 2 and includes C24, R9
L16	24K840842	IF: 2nd IF - 1; base stamped AR9; includes 46K891110 CORE, adjustable tuning; coded GREEN dot and C25, R10
L101	24A840728	RF: choke; 4 microhenry; coded WHT-BLU dot
L102	24B840042	RF: choke; 1 microhenry; coded RED-BLK dot
L103	24K840559	RF: choke; 1.2 microhenry; coded BLK-GRN dot
L104	24A855418	RF: choke; .52 uh
L201		same as L5 except 2nd Oscillator and includes C201, C202
L202	24A840728	RF: choke; 4 uh; coded WHT-BLU dot
L203		same as L102
L204	24K840559	RF: choke; 1.2 uh; coded BLK-GRN dot
P1	28K849416	CONNECTOR, plug: male; single contact; brown bakelite wafer insulator; cable mounted
		RESISTOR, fixed; carbon; 1/2 w; ins: unless otherwise stated
R1	6R6394	12K ±10%
R2	6R5591	18K ±10%
R3	6R6398	150K ±5%
R4	6R6031	100K ±10%
R5		NOT USED
R6		NOT USED
R7		NOT USED

REFERENCE SYMBOL	MOTOROLA PART No.	DESCRIPTION
		RESISTOR, (cont'd)
R8	6R6410	33K ±10%
R9		same as R8
R10		same as R8
R11	6R6428	6.8K ±10%
R12	6R6433	2.2 megohm ±10%
R13	6R6397	22K ±10%
R101	6R6031	100K
R102	6R6446	4.7 megohm ±10%
R103	6R5553	100K ±5%
R104	6R6377	470K ±10%
R105	6R6069	2.2K ±10%
R106	6R400490	8.2K ±5%
R107	6R400066	220K ±5%
R108	6R2075	12K ±5%
R109	6R6048	47K ±10%
R110	6R6479	68K ±5%
R111		same as R105
R112		same as R104
R113		same as R105
R114		same as R3
R115	6R5644	82K ±10%
R116	6R5646	390K ±10%
R117	6R6117	5.6K ±10%
R118	6R6326	100 ohm ±10%
R119		same as R103
R120	6R6270	220 ohm ±10%
R121		same as R115
R122	6R5585	8.2 megohm ±10%; used only in TA237W-R2 and TA237S-R2
R123		same as R103
R124		same as R3
R125	6R488095	18K ±5%; used in TA237W-R2 only
	or 6R5553	100K ±5%; used in TA237S-R2 only
R126	6R6414	270K ±10%; 1/2 w; ins.
R127	6R6046	1 megohm ±10%
R128	6R400228	1.5 megohm ±5%
R129	6R401006	56K ±5%
R130	6R5631	120K ±10%
R131		same as R128
R132		same as R103
R133		same as R3
R134		same as R127
R135		same as R127
R136		same as R103
R137	6R6477	15K ±10%
R138		same as R109
R139	6R401006	56K ±5% used in TA237W-R2 only
	or 6R2061	180K ±5% used in TA237S-R2 only
R140		same as R139
R141	6R5773	820K ±5%
R142	18K845110	variable; carbon; 200K ±20%; 1/4 w
R143		same as R128
R144	6R5772	47K ±5%
R145		same as R3
R146	6R6040	680 ohm ±10%; used in TA237W-R2 only
	or 6R6270	220 ohm ±10%; used in TA237S-R2 only
R147		same as R3
R148	6R6407	220K ±10%
R149		same as R148
R150		same as R127
R151		same as R13
R152	6R5796	560K ±5%; used in TA237W-R2 only
	or 6R5587	1meg. ±5%; used in TA237S-R2 only
R153	6R6497	3.3 megohm ±10%
R154	6R490110	3.9 megohm ±10%
R155	6R2089	1.8K ±10%

REFERENCE SYMBOL	MOTOROLA PART No.	DESCRIPTION
		RESISTOR, fixed; carbon; 1/2 w; ins: unless otherwise stated
R156	6R6434	27K ±10%
R157		same as R156
R158	6R2097	6.8 megohm ±10%
R159	6R400334	12 megohm ±10%
R160	6R6475	680K ±10%
R161		same as R101
R162		same as R104
R163		same as R128
R164		same as R120
R165		same as R8
R166		same as R11
R201	6R400066	220K ±5%
R202	6R2075	12K ±5%
R203		NOT USED
R204		NOT USED
R205	6R400490	8.2K ±5%
T1	1V842353	TRANSFORMER, discriminator: base coded BLUE dot; includes two 76A824495 CORE, adjustable tuning; coded YELLOW dot and C26, C27, C28, C29, C30, C31, R11, R12, R13
T101	25K847479	AF: output; 5000 ohm to 3.2 ohm at 55 ma. dc
V101	19ST170A01	TUBE, electron: type 6AK5
V102	19ST225A01	type 6BC5
V103	19ST212A01	type 6AB4
V104	19ST175A01	type 6BH6
V105	19ST113A02	type 12AT7
V106	19ST147A03	type 6CB6
V107		same as V106
V108		same as V106
V109		same as V104
V110	19ST176A01	type 6BJ6
V111	19ST111A03	type 6AL5
V112		same as V104
V113	19ST179A01	type 6C4
V114		same as V105
V115	19ST101A01	type 6AQ5
V201		same as V102
W1	30B849414	LINE; RF transmission: assembly; includes: 30B850951 CABLE, RF: coaxial; RG-58A/U; 4" length required reference part P1
XV101	9B834083	SOCKET, tube: female; 7 contact; miniature; molded mica filled phenolic base; saddle mounting; includes center shield and tube shield base
XV102		same as XV101
XV103	9K87124	7 contact; miniature; molded mica filled phenolic base; saddle mounting; includes center shield
XV104		same as XV103
XV105	9B881243	9 contact; miniature; molded mica filled phenolic base; saddle mounting; includes center shield and tube shield base
XV106		same as XV101
XV107	9B87123	7 contact; miniature; molded black phenolic base; saddle mounting; includes center shield

REFERENCE SYMBOL	MOTOROLA PART No.	DESCRIPTION
		SOCKET, tube: female;
XV108		same as XV107
XV109		same as XV107
XV110		same as XV107
XV111		same as XV107
XV112		same as XV107
XV113		same as XV107
XV114	9B86868	9 contact; miniature; molded black phenolic base; saddle mounting; includes center shield
XV115		same as XV107
XV201		same as XV101
XY101	9K857508	SOCKET, crystal: female; 4 contact; square molded black bakelite base; chassis mounted
XY102	9K861367	2 contact; rectangular; black phenolic base; chassis mounted
XY201		same as XY101

FILTER

	TU540W	PERMAKAY IF Filter; used in 60 kc model
	TU540S	PERMAKAY IF Filter; used in 30 kc model

CRYSTAL

NOTE

Crystals are part of the Radio Set model. When ordering a receiver chassis only, crystals must be ordered separately. Crystal type number and operating frequency must be specified when ordering crystal.

Y101	RM10-A	CRYSTAL UNIT, quarts: Receiver Control; for 144-174 mc carrier frequency; includes 12 volt heater unit
Y102	Type G03	Receiver IF; 12.455 mc
Y201		same as Y101

PERFORMANCE SPECIFICATIONS

INPUT REQUIRED	12 v dc negative or positive ground.
OUTPUT RATINGS	Transmitter:
	High B+ . . . . . 400 v dc at 150 ma
	Low B+ . . . . . 275 v dc at 60 ma
	Osc. B+ . . . . . 150 v dc at 18 ma
	Bias . . . . . -23 v dc
	Receiver:
	B+ . . . . . 200 v dc at 75 ma

The power supply chassis mounts between the transmitter and receiver of the radio set. The dc input and control circuits are brought in through a 19-pin male connector in the front panel. The various rectified outputs are routed to terminal boards on the wiring side of the chassis for the transmitter and receiver connections. An 18-lug terminal strip on one side is used for the transmitter connections; a 15-lug strip on the other side is for receiver connections.

Two alloy junction P-N-P transistors, designed for high power audio frequency applications, are connected in an electronic switching circuit which is basically a multivibrator. The operating frequency is in the audio range.

The transistors are mounted on a cast-aluminum radiator (called a "heat-sink") on the front panel of the radio set. The radiator conducts heat away from the transistors, permitting them to operate safely at relatively high ambient temperatures. The heat-dissipating capacity of the heat-sink provides safe operation under the most adverse temperature conditions normally encountered in mobile radio operation.

CAUTION

The transistor feedback circuit in this power supply is under a protective cover. The cover prevents accidental shorting of the enclosed components with consequent damage to the transistors. Do not remove this cover unless necessary for servicing components. Always replace the cover before restoring operation.

3. OPERATION

a. Introduction

The function of the mobile radio power supply is to convert the low-voltage dc input to the various high-voltage dc outputs required for operation of the transmitter and receiver. This is accomplished in several steps, each of which is treated separately in succeeding paragraphs.

First. Changing the dc into ac -- Transistor Circuit.

Second. Stepping up the voltage of the ac -- Power Transformer.

Third. Converting the high voltage ac to dc -- Rectifier-filter Networks.

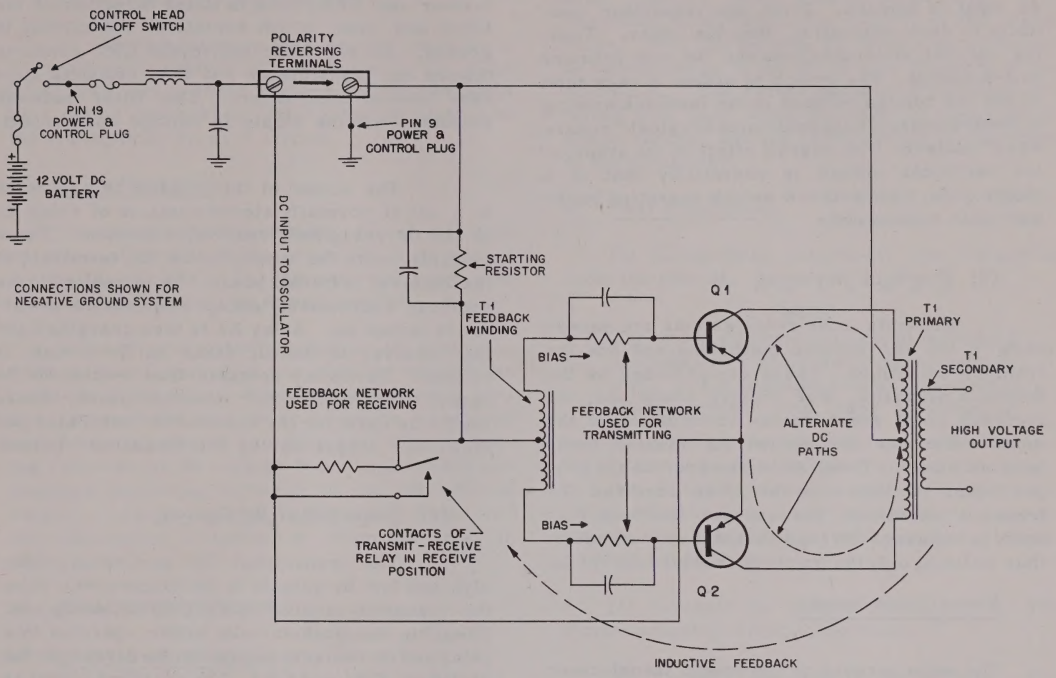
b. Transistor Multivibrator Circuit

(1) Function

The function of the transistor multivibrator circuit is to change the pure dc input into pulsating dc, a form of ac, so that it can be stepped-up in voltage by transformer action. The operation is illustrated in the simplified functional diagram, Figure 1. The diagram shows a negative ground electrical system. For a positive ground electrical system, reverse the leads to the polarity reversing terminals.

(2) Operation

The ON-OFF switch at the control head connects the 12 volt dc input to pin #19 of the



power and control plug on the power supply. When the switch is ON, one side of the dc input positive potential is applied to the transistor emitters and the receive feedback network. The negative side is connected to the primary center tap of the transformer and the starting resistor.

(a) Feedback Path

The path through the "receive" feedback network leads to the center tap of the feedback winding of the transformer. The opposite ends of this transformer winding are connected to the two transistor base elements. The starting resistor is connected between the center tap and the dc input. Current flows through the feedback network and starting resistor, applying a bias to the base elements of each transistor. Due to a slight unbalance in transistor conductivity, one will tend to conduct more heavily than the other. This is the effect which starts the oscillation cycle.

(b) Transformer Primary Path

The dc path through the center tap of the main transformer primary winding leads to the two transistor collector elements, which are connected to opposite ends of the winding. The slight unbalance in transistor conductivity causes more current to flow through one primary half-winding than through the other. The current path is through the primary half-winding and the transistor (emitter-to-collector) to the dc input. The current in the transformer half-winding induces voltages in the two feedback half-windings. Polarity is such that the more heavily conducting transistor is quickly biased to full conduction; the other transistor is quickly driven to cut-off.

(3) Oscillation Cycle

The induced feedback voltage drops to zero as the current through the conducting transistor reaches the point of saturating the transformer core. The cut-off transistor begins to conduct, reversing the polarity of the voltage in the feedback windings and conduction through this transistor increases inducing greater feedback bias and quickly cutting off the first transistor. Current through the second transistor then reaches core saturation, completing a cycle of oscillation. The circuitry is designed for self-sustaining, continuous oscillation as long as the

dc input is applied. First one transistor conducts to core saturation, then the other. Thus, the current alternates between the two primary half-windings. The switching action is very rapid and the voltage induced in the feedback winding of the transformer approximates a typical "square wave" pattern. The overall effect of the transistor oscillator circuit is essentially that of a single-pole, double-throw switch operating back-and-forth continuously.

(4) Feedback Networks

Separate drive requirements are necessary - one for receive conditions and one for transmit conditions. These are provided by the feedback networks. For receive conditions, the feedback paths are a series combination of the receive feedback network and the transmit feedback networks. These networks provide the proper bias. To increase the drive required for transmit conditions, the receive feedback network is bypassed through closed relay contacts, thus utilizing only the transmit feedback networks.

c. Power Transformer

The main purpose of the power transformer is to provide a high voltage ac output with a low-voltage ac input. A special transformer is used in this power supply to provide the feedback required for the transistor oscillator circuit in addition to the high voltage ac output. There are two separate high voltage secondaries for the B+ outputs and one low-voltage secondary for the bias supply.

d. Rectifier-Filter Networks

Refer to Schematic Diagram 63E856657.

(1) Receiver B+ Section

The receiver B+ rectifier-filter network converts the high voltage ac induced in the transformer secondary to a smooth dc output required for the receiver plate circuits. This section consists of a full-wave silicon bridge rectifier (CR5, CR6, CR7 and CR8) a "pi" section filter and a bleeder resistor.

The high voltage ac is connected to opposite corners of the bridge circuit. On one half-cycle rectifier CR5 conducts toward the transformer and CR8 conducts in the direction of the filter and load, which completes the circuit to ground. On the other half-cycle CR7 conducts toward the transformer and CR6 conducts current toward the filter. The filter network smoothes out the ripple in voltage and current.

The output of this section is connected to a set of normally closed contacts of relay K1 in the de-energized (receive) condition. These contacts route the output to the B+ terminals of the receiver terminal board. B+ is applied to the receiver continuously except when the transmitter is turned on. Relay K1 is then energized and the receiver is muted, since its B+ circuit is broken. The relay contacts then switch the B+ output to the transmitter terminal board, where the B+ is used for the transmitter oscillator and multiplier stages during the "transmit" period.

(2) Transmitter B+ Section

The transmitter B+ section provides high and low B+ outputs to the transmitter when the transmit-receive relay (K1) is energized. Pressing the push-to-talk button operates this relay and its contacts complete the circuit to the rectifier, CR2 and CR4. The rectified output is connected so that its B+ output is added to the output of the multiplier B+ section, providing a transmitter B+ of approximately 400 volts. This output is filtered and routed through closed contacts of relay K1 to the transmitter PA B+ terminal, TB3-10.

The full winding of the transformer secondary provides an intermediate B+ source for the transmitter multiplier stages. The bridge network consisting of CR5 to CR8 is used as the rectifier in this circuit. The multiplier B+ output is filtered and routed through terminals of relay K1 to the transmitter terminal board. The multiplier voltage is shorted out during receive conditions through contacts of relay K1. The transmitter oscillator screen voltage is obtained from the same source as the multiplier B+ through a dropping resistor network.

The HI-LO switch is in the transmitter (PA screen) circuit. The HI position is the normal operating position. The LO position is used for transmitter tuning purposes before the final amplifier of the transmitter is fully aligned.

(3) Transmitter Bias Section

The transmitter bias section includes a low-voltage secondary of transformer, T1, rectifier CR9 and a filter network. The -23 volts bias output appears on TB3-13 for connection to the transmitter PA grid circuit.

e. Relay Operation

The transmit-receive relay, K1, is a 12 volt dc relay. One side of the relay coil is connected to the 12 volt bus. To energize the relay, the other side of the coil must be grounded.

In the de-energized condition, all operating voltages for the receiver are supplied through the contacts of the relay. When the push-to-talk circuit is grounded, the relay becomes energized and the relay contacts are switched. The switching removes the B+ voltage from the receiver and supplies operating voltages to the transmitter stages. Therefore, the receiver is muted and the transmitter is turned on when the relay is energized.

4. TRANSISTOR CHECKING

a. Meter Considerations

A standard ohmmeter can be used to test P-N-P type power transistors for an open or short circuit. When testing transistors, it is important to establish the polarity of the meter leads. This can be done by using a dc voltmeter or by reference to the schematic diagram of the ohmmeter. The actual numerical readings obtained will vary with the type of meter used, range setting, and the condition and temperature of the transistor.

b. Test Procedures

(1) Completely disconnect the transistor from the circuit.

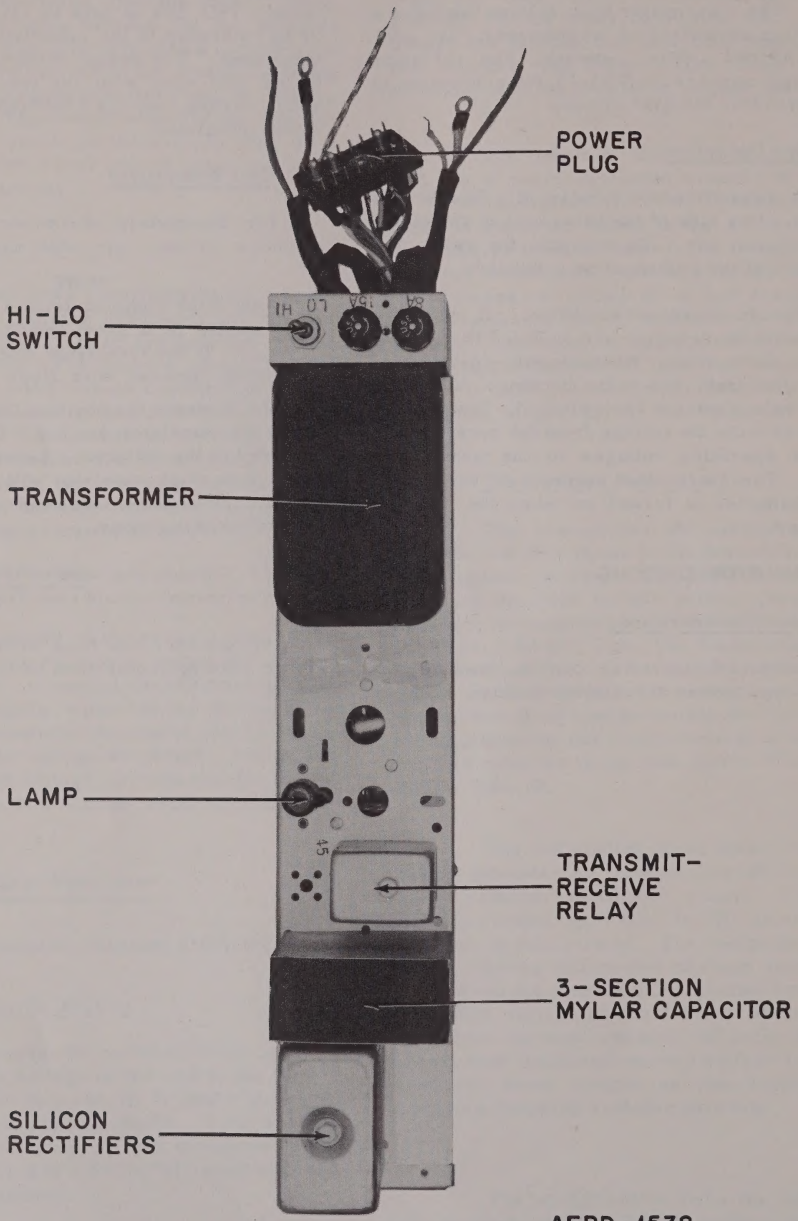
NOTE

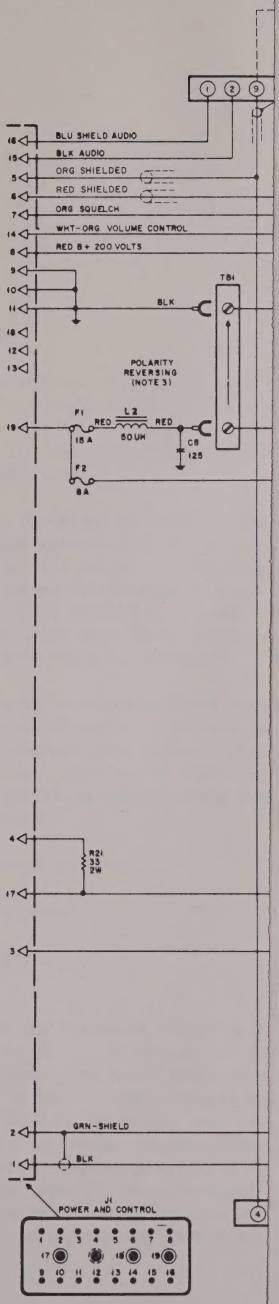
The most common failure in switching circuits is a short (emitter-to-collector). If the transistor does not show a short, proceed with steps 2 through 4.

(2) Connect the positive lead of the ohmmeter to the transistor emitter. Connect the negative lead to the collector. Leave the base circuit open. A normal transistor will indicate approximately one hundred ohms and may be as high as several hundred ohms.

(3) Connect the base to the collector. The meter indication should then drop.

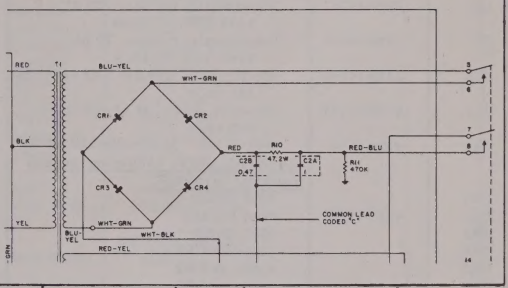
(4) Connect the base to the emitter. The meter reading should then be higher than that of step 2.


POWER PLUG
HI-LO SWITCH
TRANSFORMER
LAMP
TRANSMIT-RECEIVE RELAY
3-SECTION MYLAR CAPACITOR
SILICON RECTIFIERS
AEPD-1538



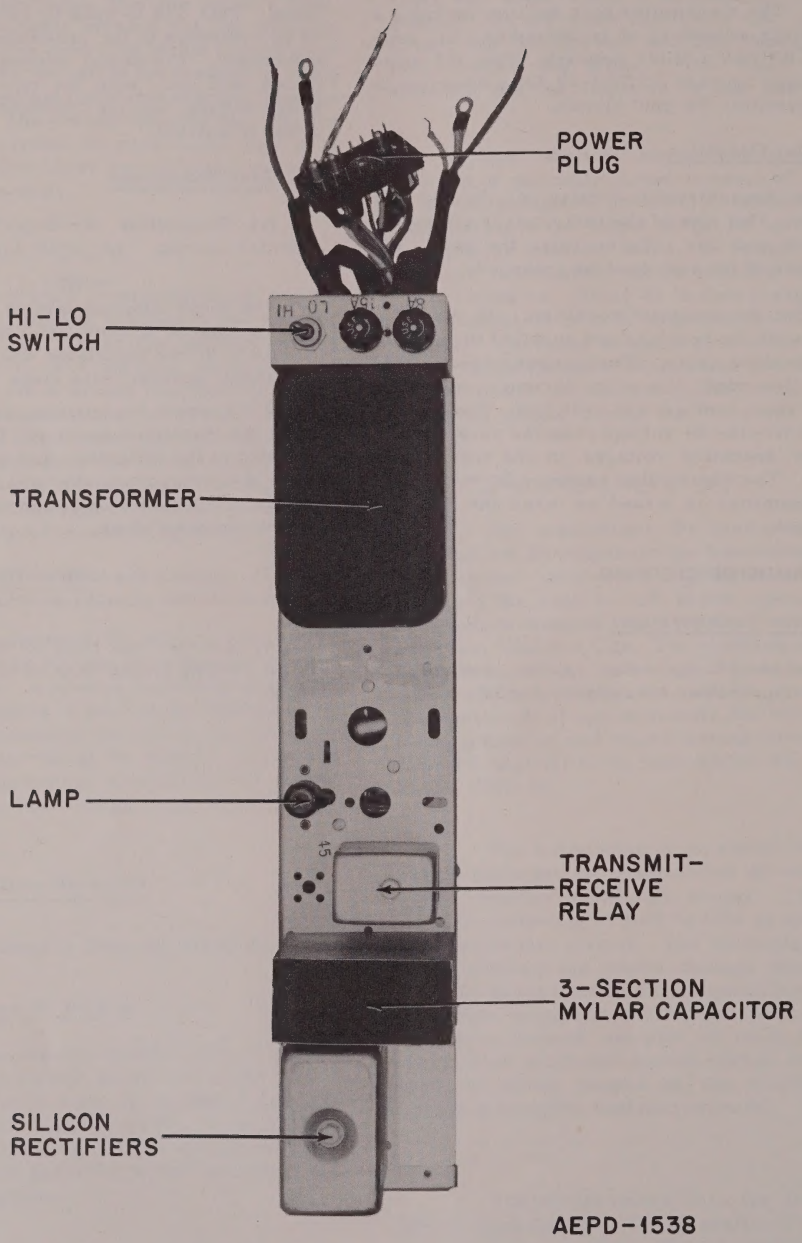
REVISIONS

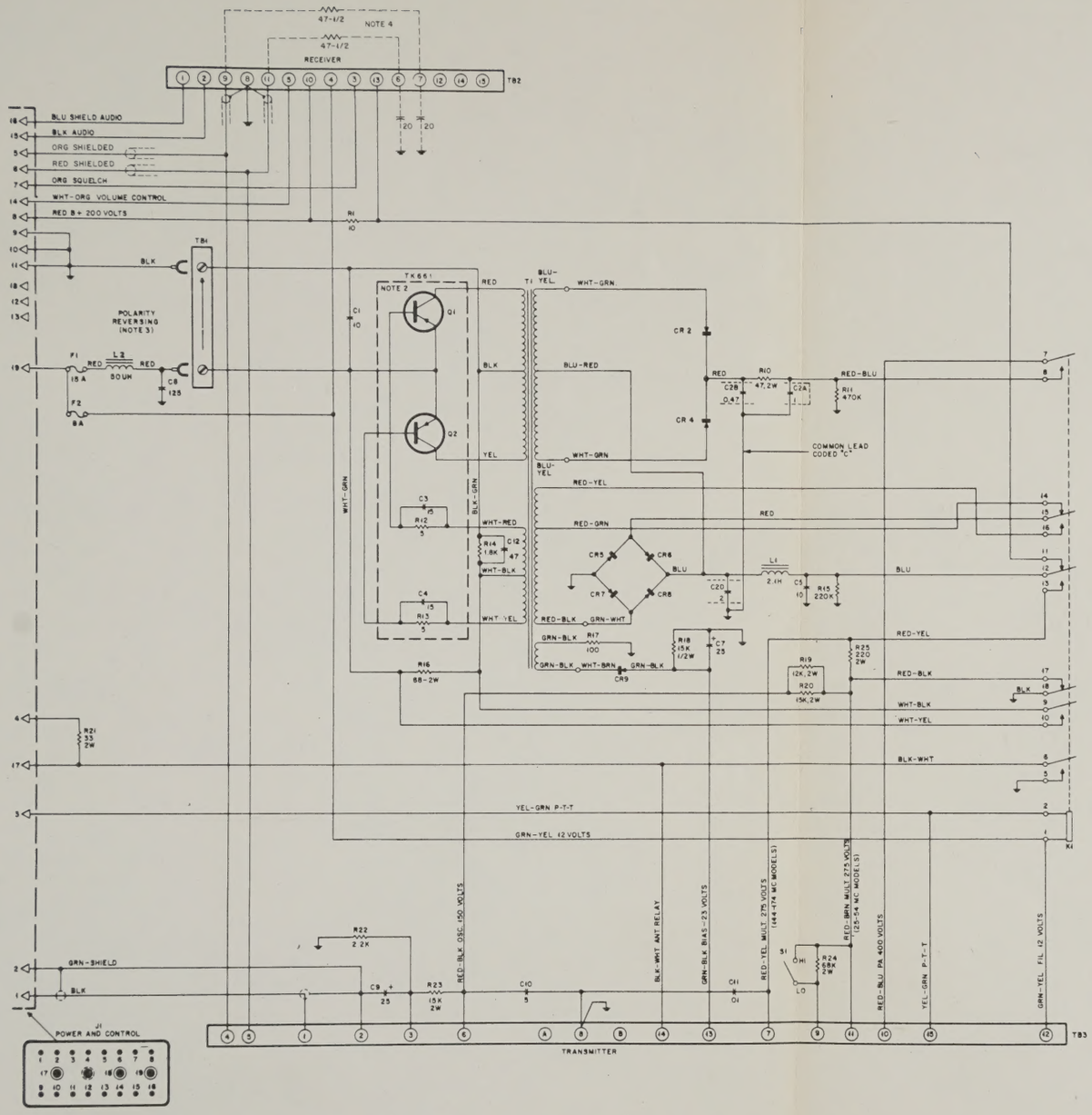
DIAG. ISSUE	CHASSIS SUFFIX	REF. SYMBOL	CHANGE	LOCATION
C	TPN6000BA-3	T1	PART NUMBER CHANGED	POWER TRANS-FORMER
		CR1	REMOVED	T1 SECONDARY CIRCUIT
		CR3	REMOVED	T1 SECONDARY CIRCUIT
			T1 OUTPUT CIRCUIT WAS	



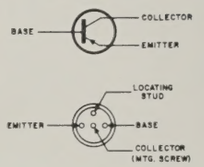
D	TPN6000BA-4		TLN6155A 2-FREQ. RCVR FILTER KIT ADDED TO SCHEMATIC FOR REFERENCE. SEE NOTE 4.	TB2 & J1
E	TK661-1	Q1, Q2	WAS 48A125286	FRONT PANEL. SEE NOTE 2

TPN6000BA Power Supply
Schematic Diagram
Motorola No. 63E856657-E
11/3/59-RCS


POWER
PLUG
HI-LO
SWITCH
TRANSFORMER
LAMP
TRANSMIT-
RECEIVE
RELAY
3-SECTION
MYLAR CAPACITOR
SILICON
RECTIFIERS
AEPD-1538

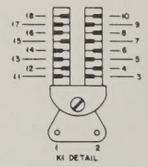


TRANSISTOR DETAIL



NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   ALL RESISTOR VALUES ARE IN OHMS, ± 10%, 1 WATT K=1000 OHMS.
   ALL CAPACITOR VALUES ARE IN MICROFARADS.
2. COMPONENTS ENCLOSED IN DASHED LINES ARE LOCATED ON FRONT PANEL.
3. POLARITY REVERSING TERMINALS SHOWN FOR NEGATIVE BATTERY GROUND (BLK TERMINAL TO ARROW). FOR POSITIVE BATTERY GROUND, REVERSE THE TWO TERMINALS (RED LEAD TO ARROW).
4. TLN6155A RCVR. FILTER KIT IS P/O 2-FREQ. RADIO SET ONLY. REFER TO INTERCABLING DIAGRAM FOR PARTS IDENTIFICATION.

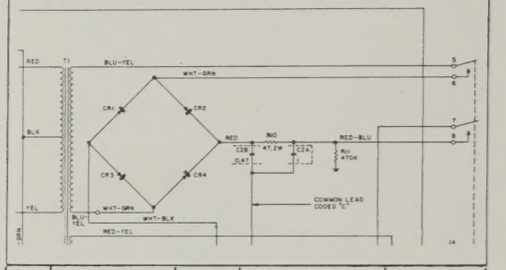


MODEL TABLE

MODEL	DESCRIPTION
TPN6000BA-4	TRANSISTOR POWER SUPPLY

REVISIONS

DIAG. ISSUE	CHASSIS SUFFIX	REF. SYMBOL	CHANGE	LOCATION
C	TPN6000BA-3	T1	PART NUMBER CHANGED	POWER TRANS-FORMER
		CR1	REMOVED	T1 SECONDARY CIRCUIT
		CR3	REMOVED	T1 SECONDARY CIRCUIT
			T1 OUTPUT CIRCUIT WAS	



D	TPN6000BA-4		TLN6155A 2-FREQ. RCVR FILTER KIT ADDED TO SCHEMATIC FOR REFERENCE. SEE NOTE 4.	TB2 & J1
E	TK661-1	Q1, Q2	WAS 48A125286	FRONT PANEL, SEE NOTE 2

TPN6000BA Power Supply
Schematic Diagram
Motorola No. 63E856657-E
11/3/59-RCS

MOTOROLA PART No.	DESCRIPTION
9B820279	FUSEHOLDER: extractor post type; molded black bakelite bayonet base; single hole chassis mounted; for 1-1/4" long x 1/4" dia fuse; includes cap, lockwasher and mounting nut same as XF1
	NON-REFERENCED PARTS
1V859763	MOUNTING BOARD ASSEMBLY, rectifier: riveted; includes: 1V859764 TERMINAL BOARD ASSEMBLY: riveted; includes 5 pairs of mounting clips and solder lug terminals 1V859765 TERMINAL BOARD ASSEMBLY: riveted; includes 4 pairs of mounting clips and solder lug terminals

ROUTINE MAINTENANCE

1. INTRODUCTION

Experience has shown that there is a particular way of maintaining 2-way radio communications equipment that is far superior to any other in achieving maximum operating efficiency and reliability at least cost.

This procedure is known as "System Maintenance", which simply means that the inspection and maintenance of all units constituting the whole is conducted in an established and orderly fashion. The procedure should be conducted at regular intervals in order to yield all of the well-known benefits of preventive maintenance.

All two-way radio communications systems include integrated assemblages. A failure in any one of these would constitute a failure of communications. However, there are three major factors in a mobile radio communications system which require attention:

a. The primary power source

b. The basic radio units

c. The antenna system

Any successful maintenance program must include the entire system. It would be of no consequence to maintain the basic radio units at top efficiency only to ignore the primary power or the antenna. A failure in either one results directly in a failure of radio communications. Therefore, to be successful in preventive maintenance, a program should be developed and closely followed on a basis of all-inclusive system maintenance. Such a program should include a periodic check on all the factors constituting a radio communications system as follows:

a. Primary Power

Automobile batteries usually fail after a long period of undercharging or overcharging, lack of water, poor connections and old age.

It is important to measure the voltage available at the battery terminals when under a load. A fully charged lead-acid battery will have a measured voltage of approximately 13.0 volts for a 12 volt battery and 6.5 volts for a 6 volt battery. An old sulphated or undercharged battery may show lower voltages. These are battery terminal voltages, not the voltage present at the radio set. The terminal voltage at the radio set will decrease when transmit current is being drawn. The voltage will be lowered approximately 1.1 volts for a 12 volt system and approximately .8 volt for a 6 volt system.

One of the good methods of checking primary power trouble is to measure battery voltage both at the terminals of the battery and at the equipment. An immediate drop in voltage of more than .2 volts measured at the battery on a short transmit cycle would indicate a battery in poor condition. A drop of more than 1 volt measured at the units would point to troubles in the primary circuit--cable, fuse block, relay or chassis return. This voltage drop is excessive and should be investigated fully.

"A" relay contacts wear out, requiring replacement.

PARTS LIST for Power Supply Diagram 63E856657-E

REFERENCE SYMBOL	MOTOROLA PART No.	DESCRIPTION
		CAPACITOR, fixed:
C1	23K859299	tantalum; 10 uf +75-15%; 25 vdcw
C2	8K861326	mylar; consists of:
C2A		1 uf ±20%; 900 vdcw; coded "A"
C2B		.47 uf ±20%; 900 vdcw; coded "B"
C2C		common connection; coded "C"
C2D		2 uf ±20%; 400 vdcw; coded "D"
C3	23K858677	electrolytic; tubular; 15 uf +100-10%; 10 vdcw
C4		same as C3
C5	23K837903	electrolytic; tubular; 10 uf +50-10%; 450 vdcw
C6		NOT USED
C7	23K850516	electrolytic; tubular; 25 uf +100-10%; 50 vdcw
C8	23K840707	electrolytic; tubular; 125 uf +100-10%; 18 vdcw
C9	23K850516	electrolytic; tubular; 25 uf +100-10%; 50 vdcw
C10	23K824135	electrolytic; tubular; 5 uf +50-10%; 250 vdcw
C11	21B801139	ceramic; disc; .01 uf +80-20%; 600 vdcw
C12	8K861614	mylar; tub. .47 uf ±10%; 100 vdcw
		CRYSTAL UNIT, rectifying: silicon junction; cartridge:
CR1		NOT USED
CR2	48K859708	type 1N1222
CR3		NOT USED
CR4		same as CR2
CR5		same as CR2
CR6		same as CR2
CR7		same as CR2
CR8		same as CR2
CR9	48K859726	type 1N1219
		FUSE, cartridge: one time;
F1	65K804906	slow blow type; glass; 15 amp; 32 volt; 1-1/4" long x 1/4" dia
F2	65K475248	slow blow type; glass; 8 amp; 32 volt; 1-1/4" long x 1/4" dia
		CONNECTOR, receptacle:
J1	28C802820	male; 19 contact; polarized; rectangular molded black phenolic insulator; chassis mounted
		RELAY, armature:
K1	80D863333	dual stack; contact arrangement; 1st stack, 1 form "B", 2 form "C", 2nd stack, 4 form "A"; coil resistance 100 ohms; does not include 15K848892 COVER, relay, nor 7A811735 BRACKET, relay cover mounting; cover and bracket must be ordered separately
		REACTOR:
L1	25B837416	filter; 2.1 henries at 100 ma dc
L2	25B861375	COIL, AF: choke; 50 microhenry
		TRANSISTOR:
Q1	48A124376	P-N-P
Q2		same as Q1
		RESISTOR, fixed: carbon; ±10%; 1 w; ins.; unless otherwise stated
R1	6R118205	10 ohm ±20%
R2		NOT USED
R3		NOT USED
R4		NOT USED
R5		NOT USED
R6		NOT USED
R7		NOT USED
R8		NOT USED
R9		NOT USED
R10	6R488035	47 ohm; 2 w
R11	6R6459	470K
R12	17C863951	wire-wound; 5 ohm; 5 w
R13		same as R12
R14	6R5620	1.8K ohm
R15	6R5574	220K
R16	6R118239	68 ohm; 2 w
R17	6R6415	100 ohm
R18	6R6477	15K; 1/2 w
R19	6R5766	12K; 2 w
R20	6R5732	15K; 2 w
R21	6R488016	33 ohm; 2 w
R22	6R6409	2.2K
R23		same as R20
R24	6R2079	68K; 2 w
R25	6R488053	220 ohm; 2 w
		SWITCH, toggle:
S1	40A482097	spst
		TRANSFORMER, power:
T1	25D865192	transistor controlled; consists of the following windings: primary #1; YEL, RED leads with BLK center tap; total resistance .045 ohms; primary #2; WHT-RED, WHT-YEL leads with WHT-BLK center tap; total resistance .085 ohms; secondary #1; BLU-YEL, BLU-YEL leads; resistance 14.5 ohms; secondary #2; RED-BLK, RED-YEL leads with RED-GRN tap; total resistance 10.3 ohms; secondary #3; GRN-BLK, GRN-BLK leads; resistance 1.81 ohms
		BOARD, terminal:
TB1	31A858723	2 screw terminals
TB2	31B802699	14 solder lug terminals; board coded 1 to 15
TB3	31B851408	17 solder lug terminals; board coded B, A, and 1 to 16
XF1	9B820279	FUSEHOLDER: extractor post type; molded black bakelite bayonet base; single hole chassis mounted; for 1-1/4" long x 1/4" dia fuse; includes cap, lockwasher and mounting nut
XF2		same as XF1
		NON-REFERENCED PARTS
	1V859763	MOUNTING BOARD ASSEMBLY, rectifier: riveted; includes: 1V859764 TERMINAL BOARD ASSEMBLY: riveted; includes 5 pairs of mounting clips and solder lug terminals; 1V859765 TERMINAL BOARD ASSEMBLY: riveted; includes 4 pairs of mounting clips and solder lug terminals

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All two-way radio communications systems include integrated assemblages. A failure in any one of these would constitute a failure of communications. However, there are three major factors in a mobile radio communications system which require attention:

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b. The basic radio units

c. The antenna system

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Automobile batteries usually fail after a long period of undercharging or overcharging, lack of water, poor connections and old age.

It is important to measure the voltage available at the battery terminals when under a load. A fully charged lead-acid battery will have a measured voltage of approximately 13.0 volts for a 12 volt battery and 6.5 volts for a 6 volt battery. An old sulphated or undercharged battery may show lower voltages. These are battery terminal voltages, not the voltage present at the radio set. The terminal voltage at the radio set will decrease when transmit current is being drawn. The voltage will be lowered approximately 1.1 volts for a 12 volt system and approximately .8 volt for a 6 volt system.

One of the good methods of checking primary power trouble is to measure battery voltage both at the terminals of the battery and at the equipment. An immediate drop in voltage of more than .2 volts measured at the battery on a short transmit cycle would indicate a battery in poor condition. A drop of more than 1 volt measured at the units would point to troubles in the primary circuit--cable, fuse block, relay or chassis return. This voltage drop is excessive and should be investigated fully.

"A" relay contacts wear out, requiring replacement.

Fuses get tired, sometimes even when new they may have too much resistance. Check and replace if voltage drop exceeds .1 volt.

Connections loosen as a result of vibration. Tighten or resolder.

Fuse Holders also loosen because of vibration. They lose their temper because of heat resulting from poor contact. Acid causes corrosion. Accumulation of oil and dirt increases contact resistance and the remedial action is to clean contacts, tighten or replace.

Keeping voltage drops to a minimum in a primary circuit is very essential to good system operation. The same rules apply to other sources of power. Dry batteries especially must be checked under full load. Some knowledge of the number of hours of use must be available as an indication of when they most likely will need to be replaced.

b. Unit Assemblages

These include transmitter, receiver, power supply, and associated units. Very few adjustments need to be made regularly in transmitter and receiver units. To catch a maximum number of incipient troubles, the technician must use his eyes, his ears, his sense of touch, and meter measurements, as well as his good judgment and past experience.

Basically four types of observation are required:

Listening Tests

An experienced technician can often detect warnings of impending trouble by noting the audio quality, the noise background and the squelch operation in relation to the settings of the volume and squelch controls. He will come to know the normal signal level he should obtain at given locations with selected stations in a particular system. Degradation of performance will be immediately apparent to the technician who checks the set periodically, whereas the steady operator may become accustomed to a gradually degraded performance.

Visual Inspections

Look for loose bolts, screws and clamps, worn handset cords, burned out pilot lights, arcing at any point, loose or broken components, burned resistors or loose connections. A good visual inspection not only is a means of quickly locating the source of trouble, but may prevent more serious trouble from developing later.

Touch

The fingers are good detectors of improper temperature conditions. Fuses, fuse holders, crystal ovens, transformers and relay coils which are too hot mean trouble. Also, a cold crystal oven, tube or resistor that should normally be warm is probably in trouble. Such tests are quick and should be used often.

Meter Measurements

Actual quantitative measurements of "A" and "B" voltages, grid and plate currents, power output, frequency and deviation have no substitute; their meaning is definite. Experience will indicate to what degree variation can be tolerated. Good test equipment is essential to good system performance.

c. Antennas

Visual check of antenna, antenna mount, cable, and connectors should be made periodically, as well as a meter check to find any open or shorted lines. Remember that the antenna must efficiently radiate the power developed in the transmitter chassis and also transfer to the receiver the minute voltages picked up from the distant transmitter to produce a good audible signal. Failure of the antenna or line is a failure of the communications system.

d. Netting

Netting of receivers and transmitters in any system is more important than usually realized. The term "netting" means that all receivers and transmitters in a given system are aligned on the same frequency or frequencies. With modern selectivity requirements, it is more than ever necessary to tune every receiver exactly to the station it must receive. Careful "netting" of all units in an integrated system to the correct frequency is a first order requirement of a modern communications system and will eliminate a prime cause of poor system performance. It is in this field of system operation that the high frequency stability and selectivity stability is of major importance.

Frequent checks of transmitter deviation will improve system operation. A good rule to follow is to check performance frequently and make

adjustments only when actual tests and measurements show improper operation.

2. MAINTENANCE CHECKS

A good preventive maintenance program requires a complete system check at least every three months and it is recommended that individual records be kept of each unit. In a general way the following items should be part of any preventive maintenance routine.

a. Clean and dust the equipment thoroughly.

b. Make a thorough mechanical inspection of the entire mobile installation.

c. Check the battery terminals. Battery connections must be clean and tight at all times to prevent power losses due to excessive voltage drops across loose connections.

d. Check the fuses. Fuses must fit snugly in the fuse holders to prevent voltage drops at these points.

e. The vehicle battery should be checked at least once a month, however, it is recommended to make this check weekly to assure that it is properly charged. A specific gravity measurement is recommended for this purpose. The reading obtained should be in agreement with the normal operating specifications stipulated by the battery manufacturer.

f. Check the A-plus voltage at the battery and at the radio set with the radio equipment turned "on" and the vehicle motor turned "off".

g. Check the dc resistance from the inner conductor to the outer conductor of the antenna coaxial lead-in cable.

h. Power Input Cables

Power cable connections may be checked by measuring the overall voltage drop from the battery to the equipment. With the transmitter "on" and the vehicle motor running, the voltage drop from the ground cable of the radio equipment to the battery ground terminal should be negligible. The voltage drop in the power cable from the (hot) battery terminal to the equipment should not exceed 1 volt. Cable voltage drop will be the difference between the voltage reading obtained from the battery terminal to ground and the reading obtained from a voltage input point on the mobile equipment to ground. These voltage measurements should be made with an accurate dc voltmeter. Proper operation of this equipment depends upon correct input voltage. The input voltage may be measured at the fuse located on the top front end of the power supply chassis (terminal with yellow lead attached). The drawer assembly must be partially pulled out of the mobile housing to permit access to convenient voltage input measuring point.

i. Vehicle Generator and Voltage Regulator

Routine Maintenance Checks should be made on the vehicle generator and voltage regulator to insure proper operation of the radio equipment. Periodic maintenance should include:

(1) Checks of generator brush condition and replacement if necessary.

(2) Checks of generator armature condition.

(3) Check of generator output and voltage regulator setting. This setting should conform to either the car manufacturer's or the generator manufacturer's recommendations.

(4) Check of generator lubrication and relubrication if required.

j. Antenna

Routine preventive maintenance of mobile systems should include a continuity check of the braided lead between the antenna rod and the coaxial lead-in. Ordinarily hidden from view within the base assembly, the lead may become frayed or broken without attracting immediate notice. However, any decrease in RF continuity introduced here will cause a decrease in radiated power and receiver sensitivity. Moreover, intermittent contact can generate undesirable interference in the form of noise caused by:

(1) high contact resistance.

(2) imperfect bonding which permits the inherent noise to enter the receiver.

k. Clean the relay contacts.

l. Check all transmitter and receiver stage meter readings and replace any tubes and transistors as required.

Transistors located in the heat sink on the front panel are coated with DC-4 silicone grease. This grease increases the rate of heat transfer.

Note that a thin mica insulator is between each transistor and the front panel. When replacing a transistor, first coat it with silicone grease and place the insulator between the transistor and the front panel. There also must be silicone grease between the mica washer and the heat sink. Replace the mica insulator if it is damaged.

m. Check the filament voltage and the B+ voltages.

n. Set the transmitter oscillators on frequency.

o. Tune the entire transmitter.

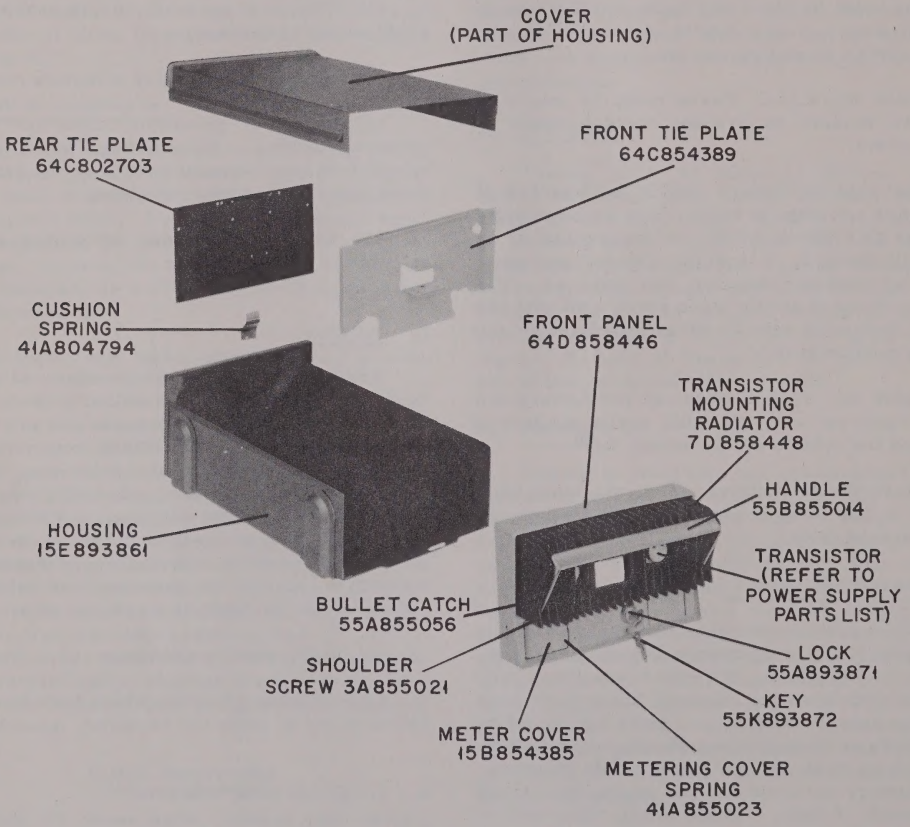
p. Check the transmitter modulation.

q. Tune the entire receiver.

r. Check the audio response against a fixed station.

NOTE

For detailed alignment procedures of the various chassis refer to the pertaining instruction section of this instruction manual.



HOUSING PARTS IDENTIFICATION DETAIL

AEPD-1285-O (CE-830) (CE1099)

SUPPRESSION OF IGNITION NOISE IN MOBILE EQUIPMENT

1. NOISE SUPPRESSION

Noise suppression requirements will vary quite widely with different vehicles, types of installation and types of system operation. System use and area coverage often determine how much noise suppression may be necessary. If the operating area is sufficiently small so that signal levels may always be high, less noise suppression will be required. Conversely for maximum range coverage and operation in weak signal areas, it becomes necessary to do a very good job of noise suppression. If the units are operating in areas with high ambient noise, it will not be necessary to do as good a job of vehicle noise suppression. It would obviously be uneconomical to spend time and money on noise suppression if the local ambient noise in the area is going to be higher than the vehicle interference levels. One of the first considerations is to determine that the noise is caused by the vehicle in which the receiver is located.

The Model TEN6018A Noise Suppression Kit is available for all vehicles equipped with two-way radio. Refer to diagram 69C854657 at the end of this section for a typical noise suppression installation.

2. SOURCE

The type of noise can generally be determined by its sound in the speaker. For best results in locating noise, the receiver should be receiving a weak signal which produces not less than 10 db. nor more than 30 db. noise quieting. Greater quieting will mask the noise by limiter action; less quieting will mask the specific noise with inherent receiver thermal noise. Impulse noise will probably be most noticeable between 20 and 30 db. of receiver noise quieting.

Ignition noise is characterized by regular "popping or snapping" heard at the speaker and will vary with the speed of the engine. This noise may be generated in the ignition coil, distributor, or the spark plugs and radiated from any lead connecting these components. A whining noise is probably generator interference. A harsh rasping noise is generated by gauges, particularly the pulsing type temperature gauge. Erratic "popping" while the vehicle is in motion is possibly the result of static electricity discharges from moving insulated parts of the vehicle. Erratic "popping" which increases as lights and other electrical accessories are turned on, can be the result of miniature arcs produced by minute potential differences between portions of the vehicle body, frame and motor block. These potential differences, for the most part, can be corrected by proper bonding practices.

3. RADIO EQUIPMENT POWER SOURCE

Power for the radio equipment should always be obtained directly from the battery rather than some other junction. Feedback and intercoupling can result between interfering currents of the vehicle electrical system and the radio circuits. In some cases these two systems can be intercoupled. It is always best to couple equipment directly to the battery to prevent this coupling as much as possible.

In addition, by connecting the radio's primary power lead directly to the battery instead of the starter key, the battery acts as a large capacitor and by-passes noise to ground. The radio ground return cable requires a secure, clean mechanical and electrical connection to the vehicle frame. The battery ground return should also be bonded to the frame. Utilizing the car frame as a common ground as much as practical, tends to minimize the possibility of inducing many unwanted parallel ground currents.

4. IGNITION

The vehicular ignition system is the worst offender from the standpoint of noise generation. The impulse noise produced must be kept under control by proper preventive maintenance and addition of suitable noise suppression items. It is necessary to check for: (1) distributor breaker points in good condition, (2) ignition condenser in good condition, (3) all ignition system connections free of corrosion and making good contact, (4) circuit continuity in the high voltage leads, (5) sufficiently high spark plug breakdown voltages, and (6) spark plug electrodes properly spaced and in good condition. Mobile installation kits usually require at least a noise suppressor resistor to be placed in the lead from the ignition coil to distributor and a shielded by-pass capacitor, to be connected from the ignition coil primary to ground.

5. RESISTANCE TYPE SUPPRESSORS

Additional elements in the ignition circuit are commonly used to attenuate the impulses. Resistor type spark plugs or spark plug suppressors, have been found to be of great assistance in many cases. While the manufacturer claims superior engine performance is obtained by using these plugs, it is recommended that a check be made to assure (1) that the proper plugs are being used, and (2) that the engine performance is at least equal to that obtained using standard plugs. The distributor noise suppressor can be eliminated if a distributor with a built-in resistor is substituted for the standard distributor. Resistance ignition cable can be substituted for standard ignition cable to obtain additional attenuation. In some cars, it has been found that excessive resistance in the spark plug circuit may produce rough idling, particularly in cold weather. Thus, it may not be possible to use a distributor noise suppressor, resistance ignition cable and resistor spark plugs simultaneously in all cars. Today some manufacturers are tending to pre-equip new models with either resistance ignition cable or resistor spark plugs, or both. In such cases, substitution need not be made. Later models have much higher ignition voltage and can, therefore, accommodate the higher total resistance.

6. SPARK PLUG LEADS

In stubborn ignition interference problems, be sure to check the continuity of the spark plug leads. Through use of an ohmmeter or some other continuity indicator, such as dry battery and small bulb, you may find one or more leads open. The first place to check is the spark plug end of the lead. In an ignition system where the end of the lead and the terminal is molded in rubber, the terminal is probably not soldered to the conductor. The connection may be strictly mechanical.

By squeezing the terminal with a pair of pliers, it may register continuity. In this case, the lead is probably satisfactory. With an intermittent indication, it may be necessary to either replace the lead or to open the terminal and solder the lead to the terminal. If the lead is replaced, be sure to check the replacement lead for continuity. If the soldered lead is in the open, be sure to provide suitable protection against weather induced terminal corrosion.

7. CONTACTS

It is always desirable to minimize the number of contacts required in an ignition system, to minimize interference as a result of poor connections. Thus, resistor spark plugs are preferred to standard spark plugs plus spark plug suppressors. Also resistance ignition cable is preferred to standard ignition cable plus series suppressors.

8. COUPLING

Ignition noise can be (1) coupled capacitively from high voltage to low voltage leads, (2) can be radiated from high voltage leads, (3) can be radiated from low voltage leads, (4) can be radiated from other metallic linkages due to shock excitation, (5) can be radiated from ignition leads, and (6) may be radiated from the distributor or ignition coil. Many trial-and-error methods of countering such problems are available, but may consume considerable time and expense in the process. Among the trial-and-error methods are those listed below.

If the lead between the ignition coil and the distributor, or any other ignition lead is a critical length for radiating on the receiver frequency, noise can be reduced by changing its length. Capacitive coupling from high voltage to low voltage leads can be minimized by achieving maximum separation between such leads. For extreme cases it can be minimized by shielding the leads or running the leads in a separate conduit. Complete shielding of the ignition coil and distributor has afforded some relief in a few stubborn cases.

9. DISTRIBUTOR

Ignition noise caused by distributor point sparking and/or radiation taking place and transmitted via associated primary wiring can be reduced by the following:

a. Install a coaxial .1 mfd capacitor at the battery input of the primary side of the ignition coil.

b. Great care should always be taken to be sure that all the wires are pushed completely down into the distributor head towers. Or, solder connections in the distributor cap towers to prevent arcs taking place in the secondary circuit.

c. Install a 10,000 ohm suppressor in the distributor center tower, if a suppressor lead is not used.

10. DC GENERATING SYSTEM

The DC generating system in a car creates a raspy sounding interference and one that is easily recognized by ear. The commutator noise and hash can be eliminated entirely by replacing the DC system with an AC generating system. If this is not contemplated, the following methods may be applied.

11. GENERATOR

Generator noise is characterized by a high pitched "whine" and varies with engine speed. With car in motion check with weak signal, ignition turned off, alternately engaging and disengaging the clutch to drive generator at various speeds.

Noise elimination in the generator system may be as follows:

a. Generator noise may be the result of dirty or worn commutators. Various manuals have instructions for balancing and dressing down dirty commutators. In some cases, commutators may be cleaned with fine sandpaper or dressing stone. Emery cloth should never be used for cleaning commutators. Generator noise can normally be kept at a low level if the brushes and commutator are kept in good condition.

b. Install a 0.5 mfd coaxial capacitor at the generator in series with the armature lead. Keep in mind that the portion of the lead between the condenser and the generator should be kept as short as possible. Any shielding that can be afforded to the armature terminal will be helpful.

c. Install a 0.5 mfd coaxial capacitor at the generator regulator (ARM) terminal in series with the armature lead to the generator.

d. Install a 0.5 mfd coaxial capacitor at the generator regulator (BAT) terminal in series with the battery lead. Keeping the leads on the regulator side as short as possible will benefit here also.

CAUTION

Do not connect a bypass capacitor directly from generator field terminal to ground. (See "Voltage Regulator").

e. In some cases it may be necessary to install shielded wiring between the generator and regulator to stop radiation from the primary winding. In such cases, it is necessary that the braid in shielding over the control wires be extremely well grounded at both ends and very near the connected items. It is necessary to run the shields up very close to the actual connection terminals in order to prevent "hot" areas from radiating interference.

f. Inductance and capacity "Pi" section filters may be sometimes required. Extremely low resistance RF filter coils, about one inch in diameter with 10 to 20 turns of #10 or #12 enameled wire, with each side bypassed to ground, through a .1 or .01 mfd. mica or good paper capacitor, physically mounted and protected will generally remove the last traces of generator noise. The Motorola P-346 generator filter can be utilized to this end.

g. Care should be used that all generator covers are free of paint and grease that might prevent good electrical connection with the generator frames.

NOTE

In all cases where coaxial capacitors are mentioned, they should not be replaced by standard by-passes. The standard by-pass displays a resonance effect with high attenuation, at about 2 megacycles. The coaxial type is non-inductive and has high attenutation, up into the U.H.F. region.

12. VOLTAGE REGULATOR

Voltage regulator noise is characterized by a "raspy" sound. Look for arcing of voltage regulator contacts. This noise may be reduced by installing a 3.3 ohm resistor in series with a .002 mfd capacitor (Maximum capacity allowable) in series with the field (F) terminal of the voltage regulator to a common ground with the generator. Resistor must be non-inductive carbon. However, three 10 ohm or 12 ohm resistors in parallel may be substituted. This voltage regulator suppression is often very important, since this noise may be as severe as the generator noise itself.

CAUTION

Never use a capacitor across the field contacts or between field and ground unless you also use the resistor, for such application will result in greatly reduced regulator life.

13. GAUGES

Gauge noise is characterized by a "hissing" or "crackling" sound which may be detected by jarring the individual gauges while the ignition switch is on. The effect of each individual gauge will be made more pronounced by disconnecting the "hot" lead of all gauges, except the one being checked. One of the most frequent offenders, the temperature gauge, can be corrected by by-passing the temperature gauge lead at the motor block with a .25-.5 mfd by-pass capacitor. However, several later models do not have the pulsing type gauge-senders. Many are merely "on" - "off" contacts associated with a red warning light for the abnormal condition.

14. OIL SENDER

Oil sender noise is characterized by a low-pitch clicking sound. The noise rate varies with the oil pressure and stabilizes at the point of maximum pressure. This interference can be eliminated by installing a .25-.5 mfd by-pass capacitor from the oil gauge lead terminal, on the oil sender, to ground.

15. STATIC CHARGES

Any moving part of the vehicle, insulated from the rest of the vehicle, can build up a static electricity potential, which discharges to produce noise. The front wheels, insulated from the axles by a film of grease, are the primary offenders on this score. Standard grounding brushes or springs, such as front wheel static eliminators, will be satisfactory in most cases where this interference is present.

16. BONDING

In most modern cars and trucks, the vehicle body and frame form the ground return for the electrical circuits. Differences in conductivity, inadequate bonds between adjacent conductors and unequal current distributions result in potential differences throughout the vehicle. The miniature arcs created by these potential differences can be eliminated by eliminating the potential differences themselves. Effective use of copper bonding braid or brass contact wipers will minimize this interference.

Bonding the hood, the exhaust pipe and the muffler, as well as the motor block to the frame will probably provide the greatest improvement. The hood can utilize contact wipers along the edges plus copper braid at the hinge. The copper braid may be placed along the edge of the body so that the hood will mesh into it as it closes. The end of the braid should be connected to the hood with sufficient slack to prevent breakage at the hinge. The exhaust pipe and muffler are often suspended from the frame with a rubber mounting, therefore good contact can be obtained only by additional bonding. Although the engine is already grounded to the frame, with copper braid, additional bonding may be required.

17. COUNTERPHASING OR NOISE BALANCING

It is a characteristic of a FM receiver that, at one point in the alignment, a null point in impulse noise response will be reached. This null may vary from installation to installation. As it leaves the factory, the receiver is tuned to the exact operating frequency and is properly adjusted for proper noise balance. However, if it is found necessary to noise balance the receiver at some future date or in some specific installation, the correct procedure should be used, as follows:

Adjustments should be made with the receiver installed in the mobile vehicle and the vehicle engine running.

a. Turn the equipment "on" and allow it to warm-up for at least five minutes.

b. Radiate a signal on the frequency of the receiver. The signal can originate from a MOTOROLA portable test set with a built-in crystal-controlled peaking generator and correct transmitter crystal, from a signal generator or from a distant transmitter.

The receiver should be on frequency. The received signal should be just strong enough to produce 10 to 30 db quieting.

c. Turn up the receiver volume to a normal listening level.

d. Start the vehicle and let the engine idle. Connect the portable test set to the receiver metering receptacle. Put the test set in position 2. If a portable test set is not available, Multimeter AN/PSM-4 may be used.

e. If adjustment of the second mixer coil does not prove effective, adjust any one of the first i-f coils until ignition noise is substantially reduced.

The first i-f coils are very sensitive and may only be adjusted a very slight amount without reducing receiver gain. When making ignition noise balance adjustments, do not decrease the meter reading more than one-half microampere.

f. If satisfactory reduction of audible noise cannot be obtained by the methods previously described, the secondary winding of the discriminator is probably not aligned to exactly 455 kc. Align the discriminator as described in the receiver alignment procedures.

Noise balancing a receiver may result in an appreciable amount of noise reduction, however, this method alone may not reduce all of the apparent ignition noise. Some vehicles with a minimum of ignition noise interference may require only noise balancing the receiver. Whereas other vehicles will require ignition noise suppression in addition to noise balancing.

18. SUMMARY

Even when no specific noise problem exists, countermeasures should be employed to maximize range and intelligibility. These countermeasures should limit the noise at its source. When noise problems do exist, follow the corrective measures suggested in the instruction manual, and include the following:

1. Check for spark plug breakdown under a compression test.
2. Use resistor spark plugs, spark plug suppressors or resistance ignition cable.
3. Check condition of generator brushes, commutator, armature co-axial and by-pass capacitors. The generator covers should be free of paint and grease that might prevent good electrical connections with the generator frame.
4. Install 3. 3 ohm resistor in series with a .002 mfd capacitor from the field terminal (F) of the voltage regulator to a common ground with the generator.
5. Check for the proper bonding, tail pipe grounded to frame with copper braid, motor block grounded to the frame, etc.
6. By-pass oil sender, gauges.
7. Check for open circuits in the high voltage leads between the spark plug and distributor.
8. Check and adjust the distributor points and check the ignition capacitor.
9. See that power for the radio equipment is obtained directly from the battery.
10. Noise balance the vehicle radio receiver.

Specific noise sources may be isolated to some extent, under specific conditions. When the vehicle is standing still with the ignition switch off, any noise heard will probably be external to the vehicle. Static discharge noise will be added when the vehicle is moving with the ignition switch off. If the vehicle is coasting in gear, with the ignition switch off, generator noise will be added to the others, if present. Noise produced by inadequate bonding will be most noticeable when maximum current is being drawn from the battery, and may be increased when the vehicle is in motion. Care should be used to be sure that noise tests are made both with and without weak signals. Also, care should be used to check with squelch control in the unsquelched or maximum sensitivity condition.

Radiating a signal from the Model 80R generator to the vehicle antenna system is most useful in establishing a reference level to determine when any improvement in noise reduction is made.

The use of a co-axial flexible lead, with a probe pick up loop about one inch diameter, connected to a separate powered radio set or oscilloscope and utilized as a search wand to find the hottest areas, has been found to be most useful.

It is impossible to give an exact procedure to counteract noise in all cases; too many variables exist. With an understanding of some of the sources of noise, an intelligent approach will often save considerable time. Ignition noise suppression can add to both operational efficiency and operator satisfaction.

Other suggestions for noise suppression aids are as follows:

DESCRIPTION	PART NO.
Hood Wiper Kit	1V81618
Incl.: 4 Hood Wipers	39A4205
4 Tapping Screws (8x3/8).	3S7516
Wheel Static Collector Assembly.	1K534254
Incl.: 2 Wheel Static Collectors	1K534255
2 Wheel Static Collector Springs. . .	41B534253
2 Wheel Static Collector Contacts . .	39A534252

NOISE IDENTIFICATION AND SUPPRESSION CHART

Characteristics of Noise at Speaker	Source of Noise	How to Check Source of Noise	How to Suppress Noise
Identified as popping sound	Ignition	Noise varies in frequency with engine speed and will disappear when ignition is switched off.	1. Check to be sure: (1) Distributor breaker points are in good condition. (2) Ignition condenser is in good condition. (3) All ignition system connections are free of corrosion & making good contact. (4) THERE IS DC CONTINUITY IN HIGH VOLTAGE LEADS. (5) There are sufficient high spark plug breakdown voltages. (6) Spark plug electrodes are properly spaced and in good condition.

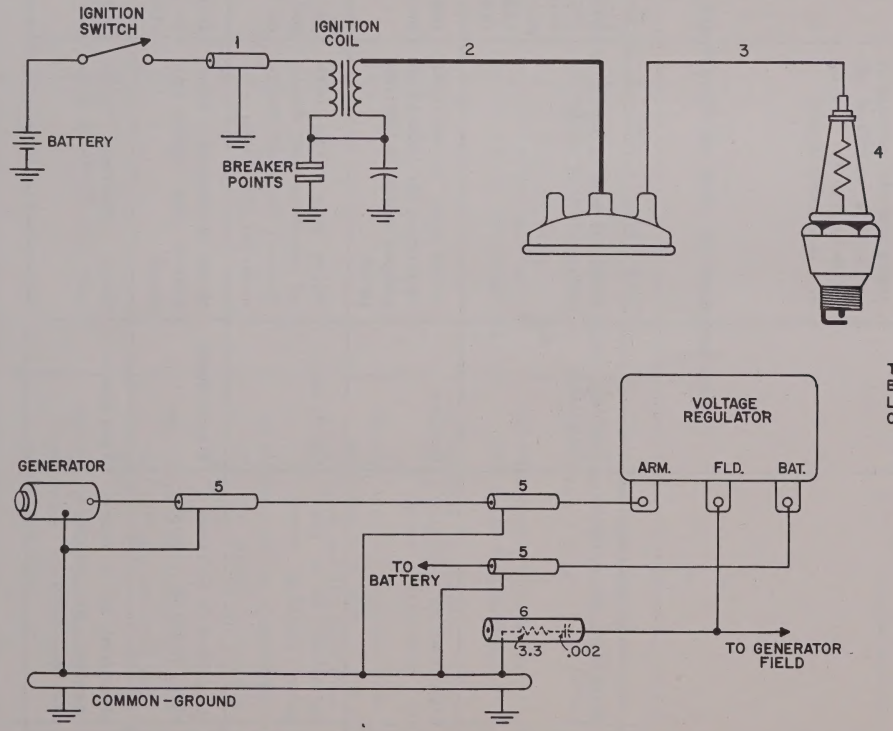
NOISE IDENTIFICATION AND SUPPRESSION CHART (Cont'd)

Characteristics of Noise at Speaker	Source of Noise	How to Check Source of Noise	How to Suppress Noise
			2. Bond each corner of the motor block to chassis ground using a heavy copper grounding braid. 3. Damp the high voltage by installing a resistor suppressor in the distributor rotor lead, or suppressors in the ignition cables or on top of the spark plugs. 4. Install resistor spark plugs or ignition cables.
Identified as a high pitched whine	Generator	Noise varies with engine speed and will persist if ignition is switched off while engine is running at a moderate speed.	1. Install a .25 - .5 mfd. coaxial capacitor at the generator in series with the armature lead. 2. A hand wound choke in series with the generator field has been used with considerable success. 3. Install a MOTOROLA Model P-346 Generator Filter in series with the armature.
Identified as a raspy sound	Voltage Regulator	Look for arcing of voltage regulator contacts.	Install .25 - .5 mfd. coaxial capacitors at the battery (BAT.) terminal in series with the battery lead and at the generator (ARM) terminal in series with the armature lead.
Identified as a hissing or crackling sound	Gauges	Noise may be detected by jarring the individual gauges while the ignition is on.	Install .25 - .5 mfd. by-pass capacitors where needed.
Identified as a low-pitch clicking sound	Oil Sender	Noise rate varies with oil pressure and stabilizes at point of maximum oil pressure.	Install .25 - .5 mfd. by-pass capacitor from gauge lead terminal on Oil Sender to chassis ground.
Identified as an irregular popping sound	Wheel Static	Noise disappears when brakes are lightly applied.	Install suitable grounding brushes or springs such as front wheel static eliminators.
Identified as a more regular or sharper popping sound	Tire Static	Noise becomes much worse at 30-50 m.p.h.	Use anti-static powder in tire tubes.

Typical Noise Suppression Detail
Motorola No. 69C854657-A
11/3/59-RCS

NOTES:

1. THE 0.1 UF COAXIAL CAPACITOR SHOULD BE MOUNTED AS CLOSE TO THE IGNITION COIL PRIMARY INPUT AS POSSIBLE.
2. EITHER A SUPPRESSOR CABLE OR A RESISTOR SUPPRESSOR IN THE DISTRIBUTOR ROTOR LEAD OR BOTH MAY BE USED ACCORDING TO THE REQUIREMENTS OR THE LIMITATIONS OF THE INDIVIDUAL INSTALLATION. SEE PARAGRAPH 5 OF THIS SECTION FOR FURTHER DETAILS.
3. EITHER RESISTOR SUPPRESSORS IN THE DISTRIBUTOR SPARK PLUG LEADS, OR RESISTANCE WIRES, OR RESISTANCE SPARK PLUGS OR ANY COMBINATION MAY BE USED ACCORDING TO THE REQUIREMENTS OR THE LIMITATIONS OF THE INDIVIDUAL INSTALLATION. SEE PARAGRAPH 5 OF THIS SECTION FOR FURTHER DETAILS.
4. THE 0.5 UF COAXIAL CAPACITORS SHOULD BE MOUNTED AS CLOSE TO THE GENERATOR AND THE REGULATOR AS POSSIBLE.
5. NOISE SUPPRESSION CAN BE ACHIEVED ONLY IF COMPONENTS ARE PROPERLY GROUNDED. BE SURE ALL COMPONENTS ARE PROPERLY GROUNDED.



TYPICAL NOISE SUPPRESSION DETAIL

THIS DIAGRAM IS A SUGGESTED NOISE SUPPRESSION SETUP. IT MAY BE USED IN ITS ENTIRETY OR IN PART, ACCORDING TO THE NEEDS OR LIMITATIONS OF THE INDIVIDUAL INSTALLATION. (SEE TEXT FOR COMPLETE INFORMATION.)

REF. SYM.	DESCRIPTION	PART NO.
1	*COAXIAL CAPACITOR, 0.1 UF	8B839908
2	*SUPPRESSOR CABLE	30A502396
3	RESISTIVE WIRE	SEE AUTO PARTS DEALER
4	RESISTOR SPARK PLUG	AUTO-LIGHT OR CHAMPION
5	*COAXIAL CAPACITOR, 0.5 UF	8K839909
6	*GENERATOR FIELD SUPPRESSOR ASSEMBLY (3.3Ω RESISTOR & .002 UF CAPACITOR)	1V80700A89

* THE TEN6018A NOISE SUPPRESSION KIT CONSISTS OF THE ITEMS MARKED WITH AN ASTERISK.